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OFFICE OF WATER RESEARCH AND TECHNOLOGY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 24
DECEMBER 15, 1981

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

GEOTHERMAL EVALUATION OF THE THRUST ZONE IN SOUTHEASTERN IDAHO,
Idaho Water and energy Resources, Research Inst., Moscow.
For primary bibliographic entry see Field 2F.
W81-06053

2. WATER CYCLE

2A. General

HYDROGEOLOGIC SETTING OF THE GLACIAL LAKE AGASSIZ PEATLANDS, NORTHERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-06092

ANALYSIS OF STREAM-AQUIFER SYSTEM INTERRELATIONSHIPS IN THE BIG BLUE AND LITTLE BLUE RIVER BASINS IN GAGE AND JEFFERSON COUNTIES, NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
M. J. Ellis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-245870, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-29, 1981. 49 p, 11 Fig, 4 Tab, 42 Ref.

Descriptors: *Streams, *Aquifers, *Surface-groundwater relations, Aquifer characteristics, Seepage, Sites, Drainage area, Flow measurement, Geohydrology, Water level fluctuations, Streamflow, Data collections, *Nebraska, Big Blue River, Little Blue River.

Seepage measurements made during the fall of 1978 at 21 sites in the Big Blue River basin and at 35 sites in the Little Blue River basin were used to determine stream gains or losses in 20 drainage areas in the Big Blue River basin and 31 drainage areas in the Little Blue River basin. Analyses of data from these seepage measurements and of available hydrogeologic data indicate that the most significant ground-water contributions to streamflow in the Big Blue and Little Blue River drainage basins in Gage and Jefferson Counties, Nebr., occur where a direct hydraulic connection exists between a stream and buried coarse-grained deposits of Quaternary age. These deposits occur in two buried bedrock valleys that trend east-northeasterly across the area. The largest ground-water contributions to streamflow in the Big Blue River occur in the reaches of the river between the mouth of Mud Creek and the dam at Blue Springs (about 13 cubic feet per second) and between the mouth of Turkey Creek and the Beatrice gaging station (about 22 cubic feet per second). Groundwater contributions to streamflow also occur in two tributaries of the Big Blue River; Bear Creek (4.39 cubic feet per second) and Big Indian Creek (6.23 cubic feet per second). In the Little Blue River basin the largest contributions to streamflow occur between the mouths of Big Sandy Creeks (about 6.5 cubic feet per second) and in the vicinity of Fairbury (about 16 cubic feet per second). A ground-water contribution to streamflow of about 6.5 cubic feet per second also occurs in Rose Creek, a tributary of the Little Blue River. (USGS)
W81-06097

USE OF SATELLITE PHOTOGRAPHY IN STUDIES OF INLAND WATER BODIES AND RIVER MOUTHS,
Akademiya Nauk USSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 7B.
W81-06292

NUMERICAL SOLUTION OF SOME PROBLEMS OF TWO-DIMENSIONAL UNSTEADY PERCOLATION,
S. T. Rybakova.
Water Resources (English Translation), Vol 7, No 3, p 222-232, May-June, 1980. 7 Fig, 6 Tab, 10 Ref. Translated from Vodnye Resursy, No 3, p 72-86, May-June, 1980.

Descriptors: *Groundwater level, *Irrigation effects, *Percolation, Hydrologic models, *Model studies, Piezometric head, Recharge, Aquifers, Artesian aquifers, Computer models, Numerical analysis, Rivers, Infiltration, Irrigation wells, Unconfined aquifers, Confined aquifers.

The dynamics of groundwater levels and piezometric heads during exploitation and recharging of aquifers by wells in the presence of a rise in groundwater level created by reservoirs and canals and under infiltration from irrigation water are usually predicted by solving 1- or 2-dimensional problems of unsteady percolation. Three problems were solved using both the locally-one dimensional scheme (LOS) and the modified iterative alternating direction implicit method (MIADI). Example 1 predicted the isolines of the rise of groundwater levels for a stretch of the Itrysh River. The two methods produced similar results, but MIADI required more computer time. Example 2 calculated isolines of the depths of groundwater levels in the area of the planned Ketovo irrigation system. Similar solutions were obtained from LOS and MIADI methods, and computer time was the same. Example 3 concerned the groundwater levels and heads in the Altai territory, where irrigation water is supplied by pumping sub-surface waters from the artesian horizon from two wells. Pumping is done only for 90 days during the growing season. The LOS method produced distorted results, but the MIADI scheme, which permits larger time steps, was more suitable for this case, a problem of unconfined-confined flow in the presence of wells. (Cassar-FRC)
W81-06305

THE SWEDISH CONIFEROUS FOREST PROJECT,
Sveriges Lantbruksuniversitet, Uppsala.
F. Andersson.
Ambio, Vol 10, No 2/3, p 126-129, 1981. 5 Fig, 16 Ref.

Descriptors: *Ecology, *Forests, Nutrients, Mathematical studies, Ecosystems, *Sweden, Systems analysis, Productivity, Soil-water-plant relationships, Trees, Monitoring, Acid rain, Evapotranspiration, Infiltration, *Coniferous forests.

The Swedish Coniferous Forest Project (SWECON) has fostered the development of individual disciplines, such as plant ecophysiology and soil biology, and also encouraged interdisciplinary collaboration. The use of mathematics has allowed better definitions to be made of the problems and hypotheses, and has influenced the design of experiments. The basic research done on primary production, especially tree growth, can serve as a basis for an integration of cause and effect production research with more traditional forest production research. It is hoped that in time it will be possible to develop yield tables based on causal relationships. Meteorological information as well as energy, radiation, and water budgets is now available for some test stands. Water models covering simulated potential and actual transpiration and actual evapotranspiration, soil water content, and simulated infiltration and percolation were compared on a single data set. The work on nutrient cycling and nutrient budgets, as well as that on soil processes, provided valuable insight into environmental problems such as the effects of acid deposition. It has been possible to establish hydrogen ion budgets which can be used as an aid in comparing the atmospheric inputs of acid with the acid turnover by natural processes within the ecosystem. Inputs of nitrogen compounds in polluted rain were similarly studied. (Baker-FRC)
W81-06377

2B. Precipitation

THE HEAVY CALIFORNIA WINTER RAINS OF 1979-80 AS A MANIFESTATION OF MACROSCALE AIR/SEA COUPLING,
Scripps Inst. of Oceanography, La Jolla, CA.
J. Namias.
In: Proceedings of the Fifth Annual Climate Diagnostics Workshop, Seattle, Washington, October 22-24, 1980, National Oceanic and Atmospheric Administration, March, 1981, p 15-50. 14 Fig.

Descriptors: *Weather patterns, *Rainfall, *Water temperature, *Weather forecasting, Seasonal distribution, Coasts, *California, Precipitation, Winter.

Although the winter of 1979-80 was an extreme period in terms of precipitation, the winters of 1977-78 and 1968-69 had similar characteristics, particularly in terms of sea surface temperature patterns. These patterns involve very cold water in the Central Pacific but abnormally warm water extending southwestward from California. The anomalous gradient between these two extensive water masses was sharp and existed perhaps 25-30 degrees westward of California. The heavy rains are frequently associated with, and probably caused by large-scale interactions between the eastern Pacific atmospheric circulations and the coupled sea surface temperatures. The gradient of sea surface temperature existed for several months before the onset of the winter rains, which holds out hope for longer than one season prediction of atmospheric climatic anomalies. However, in order for the resident sea surface temperature pattern to influence the overlying atmosphere, proper reinforcement from the atmospheric pattern must occur. Coupling could occur mainly during late winter when westerlies and storm tracks are normally at their farthest south position. (Moore-SRC)
W81-06121

APPLICATION OF NEAR REAL-TIME WATER BUDGETS IN MONITORING CLIMATE-RELATED EVENTS,
Atmospheric Environment Service, Downsview (Ontario).
P. Y. T. Louie, and W. I. Pugsley.
In: Proceedings of the Fifth Annual Climate Diagnostics Workshop, Seattle, Washington, October 22-24, 1980. National Oceanic and Atmospheric Administration, March, 1981, p 158-166. 9 Fig, 1 Tab, 1 Ref.

Descriptors: *Hydrologic budget, *Computer models, *Soil water, *Snow, Snow storage, Climate, Precipitation, Model studies, Flooding, Drought, Water storage, Forest fires, Monitoring, Climatic data.

It is possible to infer from the basic synoptic observations over a region, answers to questions on drought situations, soil saturation, and flooding potential. However, by integrating the basic observed synoptic fields using a water budget concept, answers to such questions are more apparent and they can be provided in greater detail. A framework is described in which near real-time water budgets are computed on a national scale in Canada using minimum synoptic data as input. The water budget model chosen for this application is the climatic water balance technique developed by Thornthwaite and Mather in 1955. Its input requirements are modest, requiring only screen temperatures, precipitation, latitude and an estimate of the soil water holding capacity. Because snow is an important variable in the Canadian climate, a simple snow budget routine was added to the model. At the present time, 225 Canadian synoptic stations are being processed. There are plans to include 100 U.S. stations in the future to provide continuity. Two components which have been found particularly useful for identifying and monitoring significant climate-related events are the snow storage and the soil moisture estimates. By monitoring the week to week change in the snow storage term, it is possible to identify potential flood regions and assess their severity. The soil moisture term, because it simultaneously accounts for the precipitation and antecedent moisture availability and the evaporative demand of the atmos-

phere, has been found to be a useful indicator of drought and forest fires. (Moore-SRC)
W81-06124

ON THE INFLUENCE OF WARM EQUATORIAL CONDITIONS IN THE CENTRAL PACIFIC ON CLIMATIC PATTERNS IN THE UNITED STATES: 1977-80,
Scripps Institution of Oceanography, La Jolla, CA.
A. V. Douglas.
In: Proceedings of the Fifth Annual Climate Diagnostics Workshop, Seattle, Washington, October 22-24, 1980, National Oceanic and Atmospheric Administration, March, 1981, p 239-250. 13 Fig.

Descriptors: *Precipitation, *Water temperature, *Weather forecasting, *Seasonal distribution, Atmospheric pressure, Snow, Rainfall, Marine climates, Climatic patterns, United States.

Over the past three winters, precipitation in the Southwest has averaged up to 300% of normal. Each year the heavy rains and mountain snows began in January and lasted into March, with the strongest departures being located near the lower Colorado River valley. The average 700 mb height departures for January through March of these years indicate that the eastern North Pacific was characterized by strong troughing. An examination of satellite film loops indicates that a number of heavy precipitation events were associated with tropical cloud masses moving northeastward from the central equatorial Pacific. Based on correlation analysis, the observed fall SST (sea surface temperature) patterns foreshadowed abnormal lowering of 700 mb heights in the eastern North Pacific: cold central Pacific waters in the fall indicating below normal heights in winter and above normal SST's near 30 degrees N/140 degrees N being indicative of below normal 700 mb heights in the subsequent winter months. While strong interaction between the tropics and mid-latitudes in 1976 probably resulted in the initiation of the current SST pattern, the perpetuation of the anomalous SST pattern appears strongly linked to events in the North Pacific during the winters of 1978, 1979, and 1980. (Moore-SRC)
W81-06125

LONG RANGE PRECIPITATION FORECASTING WITH A NEW UW MODEL,
Wisconsin Univ.-Madison. Center for Climatic Research.
J. B. Blechman, and R. A. Bryson.
In: Proceedings of the Fifth Annual Climate Diagnostics Workshop, Seattle, Washington, October 22-24, 1980, National Oceanic and Atmospheric Administration, March, 1981, p 384-391. 6 Fig, 1 Tab, 1 Ref.

Descriptors: *Precipitation, *Weather forecasting, *Mathematical models, Model studies, Regression analysis, Forecasting.

The current version of the University of Wisconsin long range forecast model is denoted UW 80 MK II. For 1-year-ahead forecasts, UW 80 MK II compiled monthly 2X2 and 3X3 skill scores. These scores are based on equal partitioning of the data into two (2X2) and three (3X3) categories. The model outperformed persistence consistently. 8380 forecasts were analyzed (up to 19 consecutive independent years for each station) and aggregate yearly skill scores were .198 (2X2) and .050 (3X3). Based on a binominal distribution of forecast events, confidence that skill was not due to chance alone was greater than 99.9% for both of these scores. A feature missed by the model was the heavy precipitation in August 1980, in the Great Lakes area. This underscores the need for further improvement. Two possibilities are nonlinear, rather than linear regression, and areal, rather than station forecasts. Nonlinear regression would allow amplitudes of the prediction parameters to be modeled. This would help in prediction of extremes and should improve the 3X3 skill scores. Areal forecasts would allow a more complete geographical coverage, since difficult local effects, which sometimes prevent meaningful station forecasts, could be circumvented. (Moore-SRC)
W81-06126

SEASONAL VARIATION OF 10-SQUARE-MILE PROBABLE MAXIMUM PRECIPITATION ESTIMATES, UNITED STATES EAST OF THE 105TH MERIDIAN,
National Weather Service, Washington, DC.
F. P. Ho, and J. T. Riedel.
National Oceanic and Atmospheric Administration Hydrometeorological Report No 53, April, 1980. 95 p, 47 Fig, 6 Tab, 26 Ref.

Descriptors: *Rainfall distribution, *Rainfall intensity, *Rainstorms, *Seasonal variation, *Probable maximum precipitation, Projections, Project planning, Hydrologic maps, Hydrologic data.

Estimates of the upper limit to rainfall that the atmosphere can produce (probable maximum precipitation (PMP)) are given for 6, 24, and 72 hr durations for each month of the year for 10 sq mile areas. The rainfall data were obtained from a number of data sets from different recording and reporting stations within the U.S. and Canada. Development of PMP for each month consisted of the following operations on selected major record storm rainfalls: moisture maximization, transposition, and envelopment. When PMP values for 6, 24, and 72 hr are plotted on linear graph paper and joined by a smooth curve through the point of origin, the curve adequately defines PMP by 6-hr increments to 72 hr. Maps showing PMP depths at midmonth for 6, 24, and 72 hr were developed. They may be used for planning and design of any present or proposed hydrologic structure for the United States east of the 105th meridian. The PMP estimates show a smooth variation with duration, season, and location. (Brambley-SRC)
W81-06128

A METHODOLOGY FOR POINT-TO-AREA RAINFALL FREQUENCY RATIOS,
National Weather Service, Silver Spring, MD. Office of Hydrology.
V. A. Myers, and R. M. Zehr.
National Oceanic and Atmospheric Administration Technical Report NWS 24, February 1980. 117 p, 70 Fig, 22 Tab, 35 Ref, 9 Append.

Descriptors: *Rainfall, *Depth-area-duration analysis, *Areal precipitation, *Statistical methods, Hydrologic data, Mathematical studies, Frequency analysis.

A new procedure is developed for calculating fixed depth-area ratios from dense networks of recording precipitation gages. These ratios are needed to reduce published point precipitation frequencies to areal values. The approach is to fit surfaces in interstation distance-precipitation duration space to the first and second moments (mean and standard deviation) of annual maximum two-station average precipitation, and to certain other statistics of two-station precipitation. From these statistics, upper and lower bounds of the first and second moments of annual maximum true areal average precipitation are estimated by theory developed for the purpose. The positions of the areal moments between these bounds are then set by a calibration with the moments of a limited number of annual maximum multistation averages. The moments of the areal average annual maxima thus synthesized are compared with the moments of single station annual series in a formula derived from Chow's generalized frequency equation to yield depth-area ratios. The frequency factor K corresponding to the Gumbel fitting of the Fisher-Tippett Type I distribution is used at this step. The method is illustrated by application to 25 yrs of precipitation recorder data in and near Chicago; depth-area ratio results are comparable to those from previous studies. (Brambly-SRC)
W81-06129

COOPERATIVE WEATHER MODIFICATION PROGRAM,
Texas Dept. of Water Resources, Austin.
J. T. Carr, Jr.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No. WR1, p 97-104, March, 1981. 14 Ref.

Descriptors: *Weather modification, *Precipitation, *Cloud seeding, Rainfall, Clouds, Meteorological data collection, Research.

The High Plains Cooperative Program (HIPLEX), initiated in 1973, is a Federally sponsored research program in the field of weather modification. A part of the U. S. Department of Interior's Project Skywater, it involves three experimental sites in the plains states of Texas, Montana, and Kansas. The objectives of the Texas HIPLEX program are development of precipitation management to produce additional rainfall on the Texas plains, specifically, acquisition of data on cloud and precipitation climatology, establishing the relationships between large-scale weather conditions and storm clouds, establishing relationships between small-scale weather conditions and cloud development, examining cloud properties and processes, estimating precipitation from clouds with radar, evaluating behavior of cloud systems, and developing better observation and measurement methods. As yet, the data set is not extensive enough to give statistical significance to results. Meanwhile, crop response and annual rainfall changes must be used to evaluate the HIPLEX program. (Cassar-FRC)
W81-06182

2C. Snow, Ice, and Frost

DIGITIZATION OF THE NOAA/NESS CONTINENTAL SNOW COVER DATA BASE,
National Earth Satellite Service, Washington, DC.
M. Matson, and M. S. Varnadore.
In: Proceedings of the Fifth Annual Climate Diagnostics Workshop, Seattle, Washington, October 22-24, 1980, National Oceanic and Atmospheric Administration, March, 1981, p 138-143. 4 Fig, 1 Tab, 1 Ref.

Descriptors: *Snow surveys, *Snow cover, *Weather data collections, *Climatic data, Maps, Data storage and retrieval, Satellite technology, Northern Hemisphere.

The Northern Hemisphere continental snow cover data base, although not a climatology by strict definition, is being incorporated more frequently into climate modeling and diagnostic studies. In an effort to facilitate this integration, the continental snow cover data base from 1966-1980 is being digitized, using a NMC I, J box grid overlay on a polar stereographic map. Each grid box is designated snow-covered if the grid box has 50% or more snow cover. Since latitude-longitude information is also provided for each grid box, it is possible to determine the true earth surface area of each box and in turn the snow-covered area of each continent or a region of the continent. Archival of the digitized continental snow cover data will not only be on microfilm, but will include punch cards and computer compatible tape. The archival of digital continental snow cover will continue in the future, providing climate researchers with a format for analyzing snow cover compatible with other climate data bases. (Moore-SRC)
W81-06122

THE AIR FORCE OPERATIONAL GLOBAL SNOW-ICE DATA SET AS A POSSIBLE SOURCE FOR STUDIES OF SHORT-TERM CLIMATE FLUCTUATIONS,
National Weather Service, Washington, DC. Climate Analysis Center.
P. F. Clapp, and T. H. Carpenter.
In: Proceedings of the Fifth Annual Climate Diagnostics Workshop, Seattle, Washington, October 22-24, 1980, National Oceanic and Atmospheric Administration, March, 1981, p 153-157. 3 Fig, 1 Tab, 3 Ref.

Descriptors: *Snow cover, *Climatic data, *Weather data collections, *Ice cover, Snow depth, Satellite technology.

The Air Force Global Weather Central prepares an automated, operational data set for snow and ice cover both hemispheres, available in a 5-year archive, 1976 to date. Snow is updated each day and

ice, each week. Snow is given in 6 depth categories, from less than 2 inches to 10 inches or more. The snow depths are based on surface-synoptic observations aided by an elaborate snow-depth climatology. Data from military satellites are used only to eliminate snow from those sub-satellite gridpoints where the surface brightness is less than a prescribed snow threshold. Approximately 2 years of these data were acquired from an evaluation of their usefulness in monitoring short-term climate fluctuations. To date, the total areas of snow and ice were separately computed for each 10-degree longitude sector in the Nothern Hemisphere, from November 1978 to January 1980. Snow areas in 1979 were considerably smaller than those in 1978 in Europe, western Asia, and central and western North America; and higher than 1978 in central Asia. This finding is in agreement with other studies. The annual changes in ice and snow cover from 1978-79 to 1979-80 for the months November, December, and January were calculated. The signs of the snow-cover changes computed from the Air Force data agree with those of NOAA-NESS (with the exception of November) but are much smaller. (Moore-SRC)
W81-06123

ICING RUNOFF FROM MOUNTAINS OF CENTRAL ASIA AND POSSIBILITIES OF ITS REGULATION,
Akademiya Nauk SSSR, Moscow. Inst. Geografii.
A. O. Kemmerikh.
Water Resources (English Translation), Vol 7, No 3, p 210-214, May/June, 1980. 13 Ref. Translated from Vodnye Resursy, No 3, p 20-25, May/June, 1980.

Descriptors: *Ice, *Runoff, *Permafrost, Irrigation water, Glaciohydrology, Mountains, Snowmelt, Springs, Rivers, Ice jams, Water resources development, Solar radiation, Cold regions, Asia.

Icings, ice formations characteristic of the mountains of Central Asia, are associated with permafrost. These formations are widespread 2500 to 4000 meters above sea level in areas of very low winter temperatures (-60C), dry air, and sparse snow. Although little data is available on the genesis of icings, four main types may be distinguished--glacial, river, spring, and snowmelt. Glacial icings, fed by glacial, snowmelt, and subpermafrost waters, may reach 10-12 km long, hundreds of meters wide, and 2-4 meters thick at maximum development in March-April. River icings are produced when water, impeded by ice jams, penetrates cracks and forms a multilayer stratum of ice. In addition, icings occur in slopes of river valleys and on the surface of ice cover. A typical river icing in Tien Shan is 30 km long, 400 meters wide, and 1.0-1.5 meters thick. These icings generally melt by July or mid-August. Spring icings, reaching a length of 10 km, are associated with the discharge of sub- and supra-permafrost waters. Snowmelt icings of radiation origin form in high mountain zones as a result of freezing of snow waters collecting in depressions at the foot of southern exposed slopes. The largest observed was 15,000 sq meters. Total estimated volume of icings in the high mountain belt of Central Asia is 4 cu km of almost chemically pure water. Normally 5-10% of the annual river runoff is produced by icings in this area. Artificial icings to supply irrigation water and facilitate log driving have been attempted with good results and at low cost, but further study on icing inventory, genesis, and regulation is necessary. (Cassar-FRC)
W81-06284

GLACIAL RUNOFF TO RIVERS OF CENTRAL ASIA AND POSSIBILITIES OF ITS REGULATION,
Akademiya Nauk SSSR, Moscow. Inst. Geografii.
A. N. Krenke.
Water Resources (English Translation), Vol 7, No 3, p 199-209, May/June, 1980. 1 Fig, 7 Tab, 30 Ref. Translated from Vodnye Resursy, No 3, p 5-19, May/June, 1980.

Descriptors: *Glacial runoff, *Glaciers, *Water resources development, *Melting, Glaciohydrology, Water supply development, Ice, Firn, Glacial lakes, Lakes, Artificial precipitation, Precipitation, Moraines, Runoff, Dams, Solar radiation, Mountains, Ablation, Avalanches, Russia, Asia.

Final data of the Catalog of Glaciers of the USSR show that 17,950 sq km of glaciers exist in Central Asia; 3,590 sq km of these run off to China. Of the total volume of glaciers, ice constitutes 1350-1930 cu km and water, 1110-1580 cu km (lower estimates by Nye's method and higher estimates by Grosval'd's method). Total volume of glacial runoff is 17.2 to 20.7 cu km per year (1.87 to 2.42 cu km per year to China). Glacial runoff accounts for up to 40% of the total runoff from mountains during the ablation season. This volume is about half of the necessary regulatory volume and about 20% of the reservoir volume needed for obtaining such regulation. In dry years the glacial runoff is a larger proportion of river flow, 19.5%, vs 13.4% in a normal year and 9.5% in a wet year. Increasing glacial runoff by artificial means could provide up to 25-30% of total runoff in a dry year. Blackening the glacier surface with coal dust to increase melting can produce an additional 8.0-8.5 cu km per year in a dry year, a 10-15% increase in runoff from the mountains. This rate would lead to a disappearance of glaciation in 200 years. The low yield and the unknown factors in melting by blackening make this method unsuitable as an alternative or major supplement for large scale streamflow regulation projects. Other possible methods of regulating glacier melting are: induction of avalanches (1 cu km available from 20,000 km of snow fences), pumping from glacial lakes (potential 0.5 cu km in central Asia), wells for extracting intraglacial water (10 cu km), removing moraines at ends of tongues (5 cu km), building dams in the region of a riegel and in certain rivers, and artificial precipitation increase. (Cassar-FRC)
W81-06285

2E. Streamflow and Runoff

STREAMFLOW CHARACTERISTICS OF THE HUDSON BAY AND UPPER MISSOURI RIVER BASINS, MONTANA, THROUGH 1979,
Geological Survey, Helena, MT. Water Resources Div.
R. R. Shields, and M. K. White.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-247199, Price codes: A07 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-32, August, 1981. 144 p, 1 Fig, 1 Ref.

Descriptors: *Streamflow, *Flow characteristics, *Statistical analysis, Data collections, Gaging stations, Sites, Drainage area, Flood frequency, Flow duration, High flow, Low flow, *Montana, Hudson Bay, Upper Missouri River basin, Missouri River.

Statistical summaries of streamflow data for selected gaging stations are presented in this report to aid in appraising the hydrology of the Hudson Bay and upper Missouri River basins in Montana. Streamflow records are presented for 122 gaging stations for the period of record of each station. Streamflow-record collection in the Missouri River basin began in 1890 at Fort Benton, Mont. For each streamflow-gaging station selected for this report, a brief description is given for station location, drainage area, period of record, revisions of previously published records, type and history of gages, regulation and diversions, average discharge, and extremes of discharge. These data are followed by tables of monthly and annual mean discharge, flood-frequency data, low-flow and high-flow frequency data, and flow-duration information. (USGS)
W81-06090

USER'S GUIDE FOR A GENERAL PURPOSE DAM-BREAK FLOOD SIMULATION MODEL (K-634),
Geological Survey, NSTL Station, MS. Water Resources Div.
L. F. Land.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-225765, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-116, 1981. 101 p, 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Dam failure, *Floods, *Model studies, *Mathematical models, *Flood forecasting, Hydraulic properties, Hydrodynamics, Continuity equation, Momentum equation, Mannings equation, Flood routing.

An existing computer program for simulating dam-break floods for forecast purposes has been modified with an emphasis on general purpose applications. The original model was formulated, developed and documented by the National Weather Service. This model is based on the complete flow equations and uses a nonlinear implicit finite-difference numerical method. The first phase of the simulation routes a flood wave through the reservoir and computes an outflow hydrograph which is the sum of the flow through the dam's structures and the gradually developing breach. The second phase routes this outflow hydrograph through the stream which may be nonprismatic and have segments with subcritical or supercritical flow. The results are discharge and stage hydrographs at the dam as well as all of the computational nodes in the channel. From these hydrographs, peak discharge and stage profiles are tabulated. (USGS)
W81-06094

MINIMUM STREAM POWER: THEORY,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
C. C. S. Song, and C. T. Yang.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY9, p 1477-1487, September, 1980. 18 Ref.

Descriptors: *Streamflow, *Sediment transport, Mathematical studies, *Minimum flow, Maximum flow, Flow, Hydraulics, Velocity, Stream power.

The hypothesis of minimum stream power or minimum unit stream power is reexamined from the theoretical point of view in an attempt to clarify its meaning. It is shown that, in a somewhat restricted sense, the minimization theory is equivalent to the variational form of the linearized equations of motion. The total stream power, which is also equal to the dissipation integral, can be derived from the variational functional of the linearized equations of motion. Thus the theory, under some restrictions, can be used in place of the equations of motion. The main advantage of using the variational or the minimization approach as compared with the equations of motion approach is that the former is inherently more suitable for approximate and numerical solutions. The present theory is applicable for a sediment-free flow, while the theory of minimum unit stream power or minimum stream power was intended mostly for sediment-carrying rivers. However, both are believed to be special cases of a general minimization hypothesis proposed in this paper. (Baker-FRC)
W81-06173

DIFFUSION-WAVE FLOOD ROUTING IN CHANNEL NETWORKS,
Middle East Technical Univ., Ankara (Turkey).
A. O. Akan, and B. C. Yen.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY6, p 719-732, June, 1981. 9 Fig, 1 Tab, 11 Ref.

Descriptors: *Flood routing, *Channel flow, Channels, Routing, Flood channels, Open channels, *Model studies, Mathematical models.

A nonlinear diffusion wave model for flood routing in dendritic-type open-channel networks is developed and presented. Comparison of this model with dynamic wave and nonlinear kinematic wave model leads to three major conclusions. First, the proposed diffusion-wave model can satisfactorily simulate the mutual backwater effects of channels joining at a junction. Second, the proposed model is nearly as accurate as the dynamic wave model, which may be classified among the most sophisticated one-dimensional routing techniques available

in the literature. Third, the proposed model is faster and cheaper in computaton than a kinematic wave model, which may be considered as one of the simplest hydraulic routing models known. (Baker-FRC)
W81-06199

RUN HYDROGRAPHS FOR PREDICTION OF FLOOD HYDROGRAPHS,
Stellenbach Univ. (South Africa). Dept. of Civil Engineering.
L. A. V. Hiemstra, and D. M. Francis.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY6, p 759-775, June, 1981. 7 Fig, 3 Tab, 13 Ref.

Descriptors: *Flood hydrograph, *Mathematical studies, Hydrographs, *Flood peak, Maximum probable floods, *Flood forecasting, Flood protection, Flood control, Model studies.

Run hydrograph theory is developed and demonstrated for application on fully-gaged catchments. The method allows for the synthesis of the whole family of design hydrographs for each desired return period. It is suggested that a few members of the family of design hydrographs with the desired return period be considered in practical applications instead of only the one member of the family with the highest peak. This method should be especially useful in flood problems where the flood volume plays a part. In the development of the theory, hydrographs were analyzed as they occur in the record. Thus the sample of hydrographs contains many composite hydrographs. This should result in realistic design hydrographs for practical applications. In the estimation of the necessary parameters it is demonstrated that a straightforward procedure can be to calculate the underlying probability distribution parameters from a truncated sample. Truncation may be useful to emphasize the effect of the larger floods on the distribution and to ignore the smaller floods. The run hydrograph technique may also be amenable for extrapolation to ungaged catchments. (Baker-FRC)
W81-06200

MINIMUM SPECIFIC ENERGY IN COMPOUND OPEN CHANNEL,
Geological Survey, Atlanta, GA.
M. E. Blalock, and T. W. Sturm.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY6, p 699-717, June, 1981. 10 Fig, 2 Tab, 17 Ref.

Descriptors: *Open-channel flow, *Froude number, *Energy, Open channels, Flow, Model studies.

An analytical formulation of a compound-channel Froude number is presented which correctly identifies the occurrence of points of minimum specific energy for flow in compound open channels. The proposed compound-channel Froude number can be used in conjunction with existing computer programs for water-surface profile computation and is necessarily limited by the same simplifying assumptions that are associated with conventionally used one-dimensional equations of steady, gradually varied flow. The results of an experimental investigation in a laboratory flume are presented, demonstrating the existence of two points of minimum specific energy and identifying these points by the proposed compound-channel Froude number. The compound-channel Froude number is appropriate for use with the gradually varied flow equation and provides the proper check on the flow regime when used in conjunction with the standard step method of water-surface profile computation. For some compound-channel geometries characterized by wide, level flood plains, two points of minimum specific energy can be computed for certain discharges. (Baker-FRC)
W81-06201

MODELING TRANSVERSE MIXING IN NATURAL STREAMS,
Canada Centre for Inland Waters, Burlington (Ontario).
Y. L. Lau, and B. G. Krishnappan.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY2, p 209-226, February, 1981. 6 Fig, 2 Tab, 13 Ref.

Descriptors: *Mixing, *Streams, *Solute transport, Model studies, Mathematical models, Natural streams, Open-channel flow, Dye dispersion, Simulation.

A numerical model of the transverse mixing of a neutrally buoyant solute in natural channels has been developed from the Yotsukura and Sayre (1976) stream-tube or cumulative discharge concept. The equation can easily account for changes in river geometry and curvature. A field test with dye tracers verified the model's validity for use in natural streams. Simulations of the dye concentration at various transects downstream from the source were done, using different assumptions for the factor of diffusion. All simulations reproduced the narrowing and widening of the concentration profiles very well. Best results are obtained by using local values of the velocity, depth, and metric coefficient together with a transverse dispersion coefficient which can vary in the downstream direction. An analytical solution of the model equation can also approximate the concentration profiles as they change along the reach. Published data on transverse dispersion coefficients for natural streams is summarized in table form. When the dimensionless dispersion coefficient is plotted against the width-depth ratio, all but two points fall on one curve. (Cassar-FRC)
W81-06203

THE RAINSTORM WHICH CAUSED THE MORVI DAM DISASTER IN AUGUST 1979,
Institute of Tropical Meteorology, Poona (India).
For primary bibliographic entry see Field 8B.
W81-06354

STEADY SOLUTION FOR RIVER FLOW,
University Coll. of Swansea (Wales). Dept. of Civil Engineering.
R. F. Allen.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY4, p 608-611, April, 1980. 2 Fig.

Descriptors: *Steady flow, *Rivers, *Mathematical equations, Flow, Surges, Equations.

Steady flow over a simple transition is considered, since steady-state solutions form the basis of most practical river-flow calculations. Limits are determined by investigating the case when the flow over the step is critical. Bernoulli's equation is used. The demands of a steady-state solution impose limits upon some parameters. If a steady solution is not possible, a surge would move upstream from the transition and establish new parameters. This would lead to steady flow over the transition. (Small-FRC)
W81-06360

FORECASTING FOR FLOODS IN THE RIVER SEVERN CATCHMENT,
Severn-Trent Water Authority, Malvern (England).
R. A. Bailey.
Journal of the Institution of Water Engineers and Scientists, Vol 35, No 2, p 168-178, March, 1981. 7 Fig, 2 Ref.

Descriptors: *Flood forecasting, River Severn, Forecasting, Weather forecasting, Rainfall-runoff relationships, Runoff, Rainfall, Precipitation, Model studies, Flood control, Trent-Severn Waterway, Great Britain.

The close teamwork needed between hydrologists and river engineers in meeting the needs for flood forecasting are noted. The hydrologist preparing the forecast and the river engineer ready to deliver a warning must be aware of the needs of the people who are at risk, and the time it takes the police or voluntary wardens to pass on the warning. Forecasts must indicate a maximum river level and the time that it will occur. In small catchment areas the time between rainfall and peak flood levels is too short, and a 'burglar alarm' type system is worked out with the local police and emergency personnel. Some river level and rainfall stations have special dial-out devices which are actuated by a pre-set river level threshold or a pre-set rate of rainfall being exceeded. Flood duty officers need to know their catchments and keep a careful check on rainfall and river conditions, especially when the ground is saturated. The use of simple flood routing models is becoming more extensive. In its simplest form a flood model will calculate tributary inflows from levels at flow measurement stations where a reliable stage discharge relationship exists, and combine these various tributary inflows to calculate main river flood flows. Rainfall/runoff modeling and subcatchment models are also described. (Baker-FRC)
W81-06382

THE ECOLOGY OF A SMALL CHALK STREAM AND ITS RESPONSES TO DRYING DURING DROUGHT CONDITIONS,
Freshwater Biological Association, Wareham (England). River Lab.
M. Ladle, and J. A. B. Bass.
Archiv fur Hydrobiologie, Vol 90, No 4, p 448-466, 1981. 6 Fig, 2 Tab, 23 Ref.

Descriptors: *Population dynamics, *Benthos, Limestone, Streams, Shallow water, *Drought, *Ecological effects, Water shortage, Water stress, Moisture stress, Aquatic life, Benthic fauna, Benthic flora, Aquatic plants, Aquatic animals, Streamflow, Flow characteristics, Fluctuations.

The study is an attempt to synthesize an account of the flora and fauna of a fifty meter section of a small chalk stream, the Waterston Stream. Information is included about the outputs of organic detritus from autochthonous and allochthonous sources. The effects of natural fluctuations in the annual discharge regime on plant growth patterns are considered. The influence of a period during which the stream ceased to flow on the composition and numerical abundance of the fauna is described. Apium nodiflorum gained a competitive advantage over Ranunculus calcareus due to differences in tolerance to the dry conditions. Stream invertebrate communities changed a great deal in the course of the study, with forms such as Gammarus pulex practically eliminated and others, such as Ephemerella ignita, apparently gaining a substantial advantage. Populations of species with a high reproductive potential, such as Asellus spp, recovered rapidly from decreases in numbers caused during the dry period. (Baker-FRC)
W81-06395

2F. Groundwater

GEOTHERMAL EVALUATION OF THE THRUST ZONE IN SOUTHEASTERN IDAHO,
Idaho Water and energy Resources, Research Inst., Moscow.
D. R. Ralston, J. L. Arrigo, J. V. Baglio, Jr., L. M. Coleman, and J. M. Hubbell.
Research Technical Completion Report submitted to Idaho Department of Water Resources, April, 1981. 110 p, 14 Fig, 12 Tab, 50 Ref.

Descriptors: *Thermal water, *Test wells, Thermal pollution, *Fault springs, *Groundwater, Thermal conductivity, Test holes, Stream discharge, *Geothermal studies, Hydrologic data collections, Thermal stratification, Water temperature, Groundwater movement, Geohydrology, Geothermal resources, Thrust zone, Idaho, Wyoming.

This report presents the initial results of an analysis of thermal and non-thermal ground water flow systems based on hydrogeologic and hydrochemical data. the project's objectives were to: identify the structural framework and physical characteristics of the thrust belt; inventory/analyze thermal and non-thermal ground water discharges con-

trolled by thrust-related structural features; analyze the available thermal and lithologic data from deep test holes drilled in the thrust belt; and combine the results into an evaluation of the hydrogeologic controls for the geothermal system under the thrust zone area. field work in the three test subareas involved locating, measuring and sampling ground water discharges that appeared to be controlled by structural features, particularly those associated with thrust zones. Water samples were analyzed for selected chemical constituents. The physical characteristics in the Meade thrust block were analyzed for fracturing due to thrusting activity. The data analysis is not complete but some tentative conclusions have been reached. Thermal discharges are located along structural features with the hottest water issuing from deep normal faults (Cache Valley graben, Wasatch Front, Swan-Grand Valley graben). Thermal springs associated with faulting in the Meade subarea have shallow ground water flow systems, with temperatures less than 25 degrees. the hottest discharges have Na and Cl as the dominant ions; the cooler discharges have Ca/Mg and HCO dominant. Temperature data from most of the deep wells do not show a high geothermal gradient; however, four wells have above-average bottom hole temperatures indicating a possible geothermal system. (Atkins-Omniplan)
W81-06053

GROUND-WATER AVAILABILITY ON THE KITSAP PENINSULA, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
A. J. Hansen Jr., and E. L. Bolke.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $9.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1186 (WRI), 1980. 65 p, 23 Fig, 3 Tab, 10 Ref.

Descriptors: *Groundwater availability, *Aquifer characteristics, *Geology, *Potential water supply, Water resources development, Hydraulic properties, Water yield, Wells, Well data, Groundwater recharge, Pumping, Withdrawal, Water level, Water quality, Saline water intrusion, *Washington, *Kitsap Peninsula(WA).

Unconsolidated deposits on the Kitsap Peninsula, Wash., are of glacial and interglacial origin. These deposits were divided into three units based on lithology and hydraulic properties. Two of the three units are composed of layers of sand and gravel, and silt and clay. The third unit consists of silt and clay and in most places separates the other two units. Water-bearing strata in the upper unit are fairly continuous and average 15 feet in thickness. The lower water-bearing strata are not believed to be as continuous as those in the upper unit, but yield larger quantities of water to wells. The silt-and-clay unit averages 70 feet in thickness, occurs generally near sea level, and is not known to contain major water-bearing deposits. The average annual ground-water recharge to streams on the Kitsap Peninsula was estimated to be 17 times the 1975 annual ground-water pumpage for the peninsula. Some, but an unknown amount, of this water is available for increased withdrawal by wells. Increased withdrawals cause decreased streamflow, declining water levels, and increased seawater contamination. There appears to be no widespread seawater contamination of wells in the study area. Local areas where chloride concentrations from wells exceed 25 milligrams per liter are near the southern part of the Longbranch Peninsula, Horsehead Bay, Point Evans, Sinclair Inlet, Eagle Harbor, Fletcher Bay, the northern end of Bainbridge Island, and the northern tip of the Kitsap Peninsula. (USGS)
W81-06069

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1981,
Geological Survey, Salt Lake City, UT. Water Resources Div.
L. R. Herbert.
Utah Division of Water Resources Cooperative Investigations Report Number 21, 1981. 75 p, 41 Fig, 3 Tab, 2 Ref.

Descriptors: *Groundwater, *Aquifers, *Withdrawal, *Water-level fluctuations, Water quality, Wells, Water use, Water supply, Irrigation, Geohydrology, Water table, Potentiometric level, Groundwater recharge, Hydrologic data, Precipitation, Surface-groundwater relations, Hydrographs, Maps, *Utah.

This is the eighteenth in a series of annual reports that describe groundwater conditions in Utah. The estimated total withdrawal of water from wells in Utah in 1980 was about 762,000 acre-feet--about 98,000 acre-feet less than in 1979 and 44,000 acre-feet less than the average annual withdrawal during 1970-79. The decrease in withdrawal was due primarily to decreases in withdrawal for irrigation. Total withdrawal for irrigation in 1980 was about 494,000 acre-feet, which is 73,000 acre-feet less than reported for 1979. Withdrawal for public supply was 143,000 acre-feet, a decrease of 19,000 acre-feet. The quantities of water withdrawn from wells are closely related to local climatic conditions. Precipitation in 1980 was above average in most of Utah (National Oceanic and Atmospheric Administration, 1981). Of the 33 stations for which graphs of cumulative departure from average annual precipitation are included in this report, 1 had below-average precipitation in 1980. This contributed most significantly to decreased withdrawals from wells during 1980. The above-average precipitation in most parts of the State during 1980 resulted in increased water supplies, recharge of ground water, and water for reservoirs as well as decreased withdrawals from wells. This in turn resulted in a general rise of ground-water levels in many parts of the State from spring of 1980 to spring of 1981. Notable exceptions where declines occurred were in areas where local above-average runoff contributed greatly to the recharge of the ground-water reservoir in the spring of 1980 but was not a factor in the spring of 1981. Also, declines occurred in some areas of late-season withdrawals. The total number of wells drilled during 1980, as indicated by well-drillers reports filed with the Utah Division of Water Rights, was about 2 percent more than reported for 1979. The number of those wells 6 inches or more in diameter drilled for public supply, irrigation, and industrial use was about 18 percent less than reported for 1979. (USGS)
W81-06071

GROUND WATER IN THE CARBONATE ROCKS OF THE FRANKLIN AREA, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
A. Zurawski, and C. R. Burchett.
Geological Survey Open-File Report 80-410 (WRI), 1980. 37 p, 21 Fig, 10 Tab, 6 Ref.

Descriptors: *Groundwater, *Carbonate rocks, Aquifers, *Aquifer characteristics, Geology, Limestone, Groundwater movement, Drilling, Test wells, Water yield, Water level, Pumping, Drawdown, Water quality, Surface-groundwater relations, *Tennessee, *Franklin area(Tenn).

A study of ground water in the Franklin area, Tennessee, was undertaken to fill a growing need for information on ground-water occurrence in the carbonate rocks of central Tennessee. Fifteen drilling sites were selected that had one or more of the following characteristics: medium- to thick-bedded limestones within 200 feet of land surface, structural lows, significant streamflow gains and losses, elongated sinkholes, straight stream reaches, linear features or other surface indications of solution cavities at depth. The 15 test wells produced from less than 1 to about 600 gallons per minute and had an average yield of 68 gallons per minute, measured while pumping the wells with compressed air. The average driller-reported yield for the area is five gallons per minute. Specific capacities for the four highest yielding wells ranged from 0.6 to 357 gallons per minute per foot of drawdown after 8 hours of pumping at rates ranging from 70 to 225 gallons per minute. Additional drilling at two sites revealed extensive solution openings. At one site, drawdown in five observation wells did not exceed 8.5 feet during 48 hours of pumping at an average rate of 502 gallons per minute. Raw water in the test wells meets most drinking-water standards and is of rather uniform quality from well to well and throughout the year. (USGS)
W81-06072

COMPLETION AND TESTING OF MADISON LIMESTONE TEST WELL 3, NW1/4SE1/4 SEC. 35, T. 2 N., R. 27 E., YELLOWSTONE COUNTY, MONTANA,
Geological Survey, Denver, CO. Water Resources Div.
R. K. Blankennagel, L. W. Howells, and W. R. Miller.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, Price: $12.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-528, 1981. 91 p, 16 Fig, 15 Tab, 10 Ref.

Descriptors: *Aquifer testing, *Groundwater potential, *Water quality, *Borehole geophysics, Pressure head, Hydrologic data, Radioactive well logging, Chemical analysis, Limestone, Water yield improvement, *Montana, Yellowstone County, Madison limestone, Northern Great Plains.

Selected intervals in the lower and upper parts of the Mission Canyon Limestone of Mississippian age, and the Amsden Formation and Tensleep Sandstone of Pennsylvanian age, containing water with dissolved-solids concentrations of 3,000 milligrams per liter or less, were perforated through 7-inch casing that was cemented to the wells of the borehole. Total flow from all perforated intervals after development of each interval by swabbing and flowing was 125 gallons per minute. Total flow increased to 2,900 gallons per minute after acidizing and fracturing each unit through perforations. Radioactive tracer surveys indicate about 65 percent of the flow was from perforations in the upper part of the Mission Canyon Limestone. Based on analysis of data from a step-drawdown test, the values of transmissivity and coefficient of storage considered as most reasonable are 38,000 gallons per day per foot and 0.00002 respectively. Maximum temperature of water, measured at land surface, was 56.6 degrees Celsius. (USGS)
W81-06073

HYDROGEOLOGIC SETTING OF THE GLACIAL LAKE AGASSIZ PEATLANDS, NORTHERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
D. I. Siegel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-249328, Price codes; A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-24, July, 1981. 30 p, 37 Ref.

Descriptors: *Geohydrology, *Peat, *Water quality, *Water pollution effects, Bogs, Groundwater movement, Test holes, Water table, Surface-groundwater relations, Hydraulic models, *Minnesota, Glacial Lake Agassiz Peatlands.

Seven test holes drilled in the Glacial Lake Agassiz Peatlands indicate that the thickness of surficial materials along a north-south traverse parallel to Minnesota Highway 72 ranges from 163 feet near Blackduck, Minn., to 57 feet about 3 miles south of Upper Red Lake. Lenses of sand and gravel occur immediately above bedrock on the Itasca moraine and are interbedded with lake clay and till under the peatlands. Vertical head gradients measured in a piezometer nest near Blackduck on the moraine are downward, indicative of recharge to the regional ground-water-flow system. Vertical head gradients are upward in a piezometer nest on a sand beach ridge in the peatlands 12 miles north of Upper Red Lake. Numerical sectional models indicate that this discharge probably comes from local flow systems recharged from ground-water mounds located under large raised bogs. (USGS)
W81-06092

THE SURFICIAL AQUIFER IN EAST-CENTRAL ST. JOHNS COUNTY, FLORIDA,

Geological Survey, Tallahassee, FL. Water Resources Div.
E. C. Hayes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-239477, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-14, 1981. 19 p, 4 Fig, 4 Tab, 27 Ref.

Descriptors: *Aquifers, *Groundwater, *Wells, *Water supply, Water quality, Geologic units, Transmissivity, Test wells, Water yield, Water sampling, Data collections, *Florida, St. Johns County.

The surficial aquifer, a composite of confined and unconfined water-bearing zones overlying the Miocene Hawthorn Formation, is an important source of water in St. Johns County, Fla. The water from wells open to the surficial aquifer generally meets quality standards recommended by the U.S. Environmental Protection Agency for public water supplies, except for concentrations of iron that for most wells are substantially greater than the recommended limit of 0.3 milligrams per liter. Data from 12 test wells drilled to the top of the Hawthorn formation, about 100 feet below land surface, indicate that the productive zones and confining beds in the surficial aquifer are discontinuous. Test well yields from individual zones range from less than 1 to 42 gallons per minute from depths between 20 and 100 feet below land surface. The most productive zones were generally found in the Tillman Ridge area, about 10 square miles in the west-central part of the area of investigation. Analysis of an aquifer test on a well in the Tillman Ridge area indicates a transmissivity of about 6,500 to 7,000 feet squared per day. The best local source of good quality water for development of a relatively large water supply is in the vicinity of Tillman Ridge. (USGS)
W81-06096

MAP SHOWING THE POTENTIOMETRIC SURFACE OF THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND, SEPTEMBER 1979,
Geological Survey, Annapolis, MD. Water Resources Div.
F. K. Mack, J. C. Wheeler, and S. E. Curtin.
Available from the OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225, Price: $1.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File, Map, 80-959, 1980. 1 Sheet.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Groundwater, Water level, Observation wells, Coastal Plains, *Maryland, Southern Maryland, Magothy aquifer.

This map is based on measurements made on a network of 77 observation wells in southern Maryland. Highest levels of the potentiometric surface, 63 to 67 feet above sea level, were measured near the outcrop or subcrop of the aquifer in topographically high areas of Anne Arundel and Prince Georges Counties. The surface slopes to the southeast to about 5 feet above sea level along much of the western shore of the Chesapeake Bay. Four separate, distinct, and extensive cones of depression have developed in the surface around the well fields of the city of Annapolis, Broadneck, town of Waldorf, and Chalk Point. Several square miles of each cone are below sea level and in localized areas at Chalk Point and Waldorf, the surface is 40 to 50 feet below sea level. The network of wells was developed as part of the cooperative program between the U.S. Geological Survey, the Maryland Geological Survey, and the Maryland Energy and Coastal Zone Administration. (USGS)
W81-06098

HYDROLOGIC EFFECTS OF STRESS-RELIEF FRACTURING IN AN APPALACHIAN VALLEY,
Geological Survey, Charleston, WV. Water Resources Div.
G. G. Wyrick, and J. W. Borchers.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $4.50. Geological Survey Water-Supply Paper 2177, 1981. 51 p, 20 Fig, 52 Ref.

Descriptors: *Geologic fractures, *Permeability, Aquifers, *Aquifer characteristics, Geologic control, Groundwater barriers, Groundwater movement, Wells, Pumping tests, Geophysics, Surface-groundwater relations, *West Virginia, Appalachian Plateaus, Stress-relief fracturing.

A hydrologic study at Twin Falls State Park, Wyoming County, W. Va., was made to determine how fracture systems affect the occurrence and movement of ground water in a typical valley of the Appalachian Plateaus Physiographic Province. Twin Falls was selected because it is generally unaffected by factors that would complicate an analysis of the data. The study area was the Black Fork Valley at Twin Falls. The valley is about 3 miles long and 400 to 600 feet wide and is cut into massive sandstone units interbedded with thin coal and shale beds. Two sites were selected for test drilling, pumping tests, and geophysical studies. At both sites, ground water occurs mainly in horizontal bedding-plane fractures under the valley floor and in nearly vertical and horizontal slump fractures along the valley wall. The aquifer is under confined conditions under the valley floor and unconfined conditions along the valley wall. Drawdown from pumping near the center of the valley affected water levels at both sites, indicating a hydrologic connection from the upper to the lower end of the valley. Stream gain-and-loss studies show that ground water discharges to the stream from horizontal fractures beneath Black Fork Falls, near the mouth of Black Fork. The fracture systems that constitute most of the transmissive part of the aquifer at Twin Falls are like those described as being formed from stress relief. As stress-relief fractures have been described in other valleys of the Appalachian Plateaus, the same aquifer conditions may exist in those valleys. (USGS)
W81-06099

EFFECT OF WELL EXPLOITATION OF THE UPPER JURASSIC AQUIFER ON SEISMICITY OF THE CRIMEA,
Odessa State Univ. (USSR).
E. S. Shtengelov.
Water Resources (English Translation), Vol 7, No 2, p 132-139, March/April, 1980. 6 Fig, 1 Tab, 8 Ref. Translated from Vodnye Resursy, No 2, p 57-65, March/April, 1980.

Descriptors: *Water level, *Test wells, *Seismology, Earthquakes, Groundwater level, Wells, Mountains, Crimean Mountains, USSR, Water supply development, Seasonal variation.

Because flow in the Upper Jurassic aquifer in the Crimean Mountains is seasonally variable, the feasibility of using wells to withdraw water during the summer and fall months was investigated. However, seismic activity in the area is associated with low water levels. Seismic activity during test pumping of exploratory wells in the Subashi Spring area was recorded and analyzed. Seismological data on the Karabi-Yalta, Agarmysh-Sudak, and Anapa regions showed that the majority of underground shocks were related to a drop in the groundwater level. The greatest seismic activity coincided with the first periods of pumping in 1967, 1968, and 1974. None of these earthquakes was perceptible or destructive. The data do indicate the need to investigate the problem further, particularly in the Crimean Mountains. (Small-FRC)
W81-06298

ANALYSIS OF THE FORMATION OF THE HYDROCHEMICAL REGIME IN AQUIFER SYSTEMS OF THE NORHTERN DVINA DEPRESSION,
Arkhangelsk Territorial Geological Administration (USSR).
For primary bibliographic entry see Field 2K.
W81-06299

NUMERICAL SOLUTION OF SOME PROBLEMS OF TWO-DIMENSIONAL UNSTEADY PERCOLATION,
For primary bibliographic entry see Field 2A.
W81-06305

ESTIMATION OF THE RATE OF EXCHANGE OF FRESH SUBSURFACE WATERS WITH CONSIDERATION OF LEAKAGE BETWEEN AQUIFERS AND THEIR RECHARGE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
P. A. Kiselev.
Water Resources (English Translation), Vol 7, No 3, p 233-237, May-June, 1980. 1 Fig, 6 Ref. Translated from Vodnye Resursy, No 3, p 87-92, May-June, 1980.

Descriptors: *Artesian aquifers, *Recharge, *Water exchange, Groundwater movement, Aquifers, Water loss, Hydrogeology, Groundwater flow, Path of pollutants, Groundwater recharge, Leakage.

The exchange rate in aquifers is estimated under conditions in which subsurface waters are recharged or discharged along the path. Two cases are examined for artesian waters: (1) when the artesian aquifer along the flow path receives water through the top at one rate and loses it through the bottom at another rate, and (2) when the artesian aquifer is recharged or gives up water only from one side, through the top or bottom, the other boundary of the aquifer being an impervious layer. Data from the Berezina-Dnepr artesian aquifer are used in calculations. A complete exchange cycle of 185 years was determined. (Cassar-FRC)
W81-06308

STUDY OF THE WATER CONTENT OF FISSURED ROCKS BY GEOPHYSICAL FIELD METHODS,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology Moscow (USSR).
I. M. Mel'kanovitskii.
Water Resources (English Translation), Vol 7, No 4, p 334-345, July-August, 1980. 43 Ref. Translated from Vodnye Resursy, No 4, p 82-97, July-August, 1980.

Descriptors: *Groundwater potential, *Groundwater prospecting, *Fissure water, Measuring instruments, Geohydrology, Rock properties, Exploration, Field tests, Seismology, Unconsolidated aquifers, Mapping, Geologic fractures.

The determination of the water content of fissured rocks is important in searching for subsurface water deposits and in studying the conditions of their storage. This paper discusses methods of investigation applicable to 8 types of problems. Determination of thickness and composition of the unconsolidated cover deposits and the hypsometry of their bottom is done by direct-current electrical prospecting, seismic prospecting, and most frequently, by vertical electrical sounding, which gives both thickness and lithological composition of the unconsolidated deposits. Where electrical prospecting is inappropriate, as in deeply frozen rocks, seismic refraction or correlation refraction can be used. Problems of lithologic mapping can be solved by a variety of geophysical methods--magnetic prospecting, electrical profiling, gravimetry, seismic prospecting, and radiometry, or combinations of these. Fault zones are usually detected by vertical electrical sounding, dipole equatorial sounding, electric profiling, and in complex cases, by seismic prospecting. Deep geological mapping by vertical electrical sounding and seismic prospecting can distinguish between carbonate, terrigenous, and extrusive-pyroclastic rocks. Magnetic and gravity prospecting are useful in deep mapping of fold mountains and crystalline shields and in finding concealed intrusions. Mapping zones of increased fissuration uses many methods, particularly electrical prospecting. The level, direction, and flow rate of fissure groundwaters and their places of recharge and discharge are handled by vertical electrical sounding (depth to the fissure groundwater table), charged body method (direction and rate of subsurface flow), self-potential method (sites of discharge when the aquifer is covered by poorly permeable formations), and resistivity and thermometry (sites of discharge in the case of thermal and mineralized waters). An approximate estimate of mineralization of subsurface waters in fissured rocks is based on a study of their resistivity. (Cassar-FRC)
W81-06311

SUBSIDENCE IN UNITED STATES DUE TO GROUND-WATER WITHDRAWAL,
Geological Survey, Sacramento, CA.
For primary bibliographic entry see Field 6G.
W81-06338

GROWTH OF GROUND-WATER MOUND IN RESPONSE TO RECHARGE,
Indian Agricultural Research Inst., New Delhi.
N. H. Rao, and P. B. S. Sarma.
Ground Water, Vol 18, No 6, p 587-595, November-December, 1980. 3 Fig, 11 Ref.

Descriptors: *Groundwater recharge, *Mathematical equations, *Porosity, Differential equations, Water table, Groundwater, Aquifers, Laplace equation, Mathematical analysis, Seepage, Groundwater movement.

A method of identifying the extent of the groundwater mound using solutions of the equation of flow for finite aquifers is proposed. These solutions were obtained using the Baumann and Hantush procedures of linearization and Laplace transforms. The resulting expressions were of a general nature. The range of validity of the two procedures of linearization was tested using experimental results from sand tank models of finite aquifers, available in the literature. The Baumann procedure was useful up to a water table rise of 0.4 times the initial value. The Hantush method was valid up to 3 times the initial value. The effect of variation of the horizontal extent of the recharge mound on the water table profile was studied by treating the limit of the horizontal mound itself as a parameter. The water table rise was computed using the Hantush procedure for different values of the ratio of width of the mound to the width of the recharge stip. (Titus-FRC)
W81-06340

THE HYDROGEOCHEMISTRY OF THE JURASSIC LIMESTONES IN GLOUCHESTERSHIRE, ENGLAND,
Thames Water Authority, Reading (England).
M. Morgan-Jones, and M. D. Eggboro.
Quarterly Journal of Engineering Geology, Vol 14, No 1, p 25-39, 1981. 8 Fig, 4 Tab, 12 Ref.

Descriptors: *Geochemistry, *Groundwaters, Limestone, Great Oolite Series, Inferior Oolite Series, Aquifers, Chemical composition, Chalk, Great Britain, Groundwater pollution, Water quality, *Hydrogeology, Groundwater movement, Groundwater recharge, Thames Water Authority, Jurassic limestone, Gloucestershire, England.

Chemical processes in groundwaters in the Jurassic limestones within the Thames Water Authority's catchment were reviewed. Samples were collected from 77 spring and borehole sources. A suite of nine samples was collected for tritium analysis to study the recharge history of groundwater in both aquifers. Two major hydrogeological units occur in the area of study: limestones in the Inferior Oolite Series and limestones in the Great Oolite Series. These aquifer units are separated by Fullers Earth, which in this area usually acts as an aquiclude. Where the groundwaters are unconfined, they are of the Ca, HCO3 type. In areas where both limestone series are confined beneath clays there is a gradual change in the chemistry to the Na, HCO3 type. Deep in the confined limestones, particularly in the Great Oolite series, an Na, Cl component has been identified. Natural heavy-metal concentrations are generally very low except where old pipework has influenced the lead or zinc content. Significant down-dip chemical changes were noted in terms of redox conditions, pH, dissolved oxygen content, ion exchange, and the concentrations of minor constituents in groundwaters from both limestone series. In each limestone unit an oxidation reduction zone was defined. The zone occurs about 8 km down gradient from the onset of confined conditions in the Inferior Oolite, while in the Great Oolite a similar zone occurs 1-2 km into the confined area. The delay in the onset of reducing conditions in the Inferior Oolite is tentatively attributed to leakage of Great Oolite water through the intervening Fullers Earth. (Baker-FRC)
W81-06352

2G. Water In Soils

SUITABILITY FOR SEPTIC TANK FILTER FIELDS AND TAXONOMIC COMPOSITION OF THREE SOIL MAPPING UNITS IN ARKANSAS,
Ohio State Univ., Columbus. Dept. of Agronomy.
M. D. Ransom, W. W. Phillips, and E. M. Rutledge.
Soil Science Society of America Journal, Vol 45, No 2, p 357-361, March/April, 1981. 2 Tab, 15 Ref.

Descriptors: *Soil properties, *Percolation, Capillarity, Leaching, Soil porosity, Porosity, Soil profiles, Soil horizons, Soil management, Septic tanks, Wastewater, *Septic wastewater, Water tanks, Self-purification, Mapping, Washington County, Benton County, *Arkansas.

The objectives of this study were to evaluate the suitability of three mapping units of the soil surveys in Washington and Benton counties, Arkansas, for septic tank filter fields and to evaluate the taxonomic composition or purity of these mapping units. About 14 sites were selected at random in each mapping area for further evaluation. Of the 14 Peridge mapping unit pedons, seven were rated moderate by Soil Conservation Service (SCS) criteria, and 7 were rated severe due to a seasonal water table within 1.2 meters of soil surface. Eleven passed the Arkansas Department of Health (ADH) criteria, and 12 passed the U.S. Public Health Service (USPHS) criteria. All failures were due to slow percolation rates. All 15 Nixa mapping unit pedons were rated severe by SCS criteria due to slow permeability and a seasonal water table within 1.2 meters of soil surface. All pedons in this unit failed the ADH and USPHS criteria because of their fragipan. All 13 pedons of the Clarksville mapping unit were rated severe by the SCS criteria, as they were on slopes steeper than 15%. Eight failed according to the criteria of both the ADH and the USPHS, primarily due to the depth of bedrock. It is suggested that mapping units be evaluated by their range in soil properties and by their suitability for use and management in two independent steps. (Baker-FRC)
W81-06319

CONSTANT-RATE RAINFALL INFILTRATION: FIELD EXPERIMENTS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
B. E. Clothier, I. White, and G. J. Hamilton.
Soil Science Society of America Journal, Vol 45, No 2, p 245-249, March/April, 1981. 6 Fig, 1 Tab, 17 Ref.

Descriptors: *Rainfall infiltration, *Mathematical studies, Infiltration, *Soil water, Soil moisture, Soil porosity, Ponding.

Measurements were made of water content profiles developed during constant-rate rainfall at two field sites, one a fine sand in its virgin state and the other a cultivated sandy loam. The observed field profiles were compared to those predicted by the theory of constant flux infiltration. Prior to ponding, the observed field profiles agreed with those predicted by the theory of constant-flux infiltration. The predictions were based on field measurements of sorptivity and saturated hydraulic conductivity. Soil water diffusivity was scaled from sorptivity and wet front advance measurements taken with a simple device that gives the diffusivity of the soil matrix by supplying water to the soil surface at a slight suction. This is appropriate for non-ponding flux infiltration, as the soil is unsaturated. The physical properties of the matrix are shown to give the time to incipient ponding. Following saturation there may be preferential flow into the macropores such that the time to initiation of runoff will lag behind the time to incipient ponding. (Baker-FRC)
W81-06320

EFFECT OF DISSOLUTION OF ALUMINOSILICATES AND CARBONATES ON IONIC ACTIVITY PRODUCTS OF CALCIUM CARBONATE IN SOIL EXTRACTS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel).
For primary bibliographic entry see Field 2K.
W81-06321

A MACROSCOPIC BASIS FOR SOIL CHEMISTRY,
California Univ., Berkeley. Dept. of Plant and Soil Biology.
For primary bibliographic entry see Field 2K.
W81-06322

2H. Lakes

EFFECTS OF ABNORMAL THERMAL STRATIFICATION ON A RESERVOIR BENTHIC MACROINVERTEBRATE COMMUNITY,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5C.
W81-06178

AQUATIC IMPACTS OF DEICING SALTS IN THE CENTRAL SIERRA NEVADA MOUNTAINS, CALIFORNIA,
Ch2M/Hill, Inc., San Francisco, CA.
R. W. Hoffman, C. R. Goldman, S. Paulson, and G. R. Winters.
Water Resources Bulletin, Vol 17, No 2, p 280-285, April, 1981. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Deicers, *Water pollution sources, *Lakes, *Salts, Chlorides, *Highway icing, Highways, Highway effects, Lake Tahoe.

A study was conducted from May 1974 to June 1975 to survey the effects and fates of deicing salts applied along major California highways in the Central Sierra Nevada. The study area centered on Lake Tahoe basin and aquatic ecosystems near a major highway, Interstate 80. Thirty-five routine sampling sites were chosen for their proximity to highways. during the winter, chloride levels in streams below the major freeways were elevated. The high chloride levels occurred after the application of salt to the roads, decreasing as the time from application increased. Small lakes receiving runoff from the major roads were also enriched with chloride. Several of these lakes displayed a temporary chemocline, which was sufficiently strong to stabilize a temperature inversion in one lake. Data are not available which would make it possible to determine whether the lakes showing higher chloride to specific conductance ratios are in equilibrium or are increasing the chloride enrichment. While these lakes in California did not show the dramatic degradation reported for lakes in the Northeastern sections of the United States, it is suggested that continual and careful monitoring be undertaken in these California lakes. (Baker-FRC)
W81-06179

WIND-DRIVEN FLOW IN MISSISSIPPI RIVER IMPOUNDMENT,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
For primary bibliographic entry see Field 5C.
W81-06194

ANNUAL PRODUCTIVITY AND PHYTOPLANKTON CHANGES BETWEEN 1969 AND 1974 IN GULL LAKE, MICHIGAN,
Michigan State Univ., Hickory Corners. W. K. Kellog Biological Station.
B. Moss, R. Wetzel, and G. H. Lauff.
Freshwater Biology, Vol 10, No 2, p 113-121, April, 1980. 6 Fig, 2 Tab, 15 Ref. OWRT-B-021-MICH(3), and B-032-MICH(3).

Descriptors: *Lakes, *Eutrophication, Phosphates, Fertilizers, Agricultural chemicals, *Phytoplankton, Trophic level, Algal growth, Aquatic productivity, Gull Lake, *Michigan.

Gull Lake is an important recreational lake in southern Michigan. Accounts of its geography, phytoplankton populations and limited aspects of its water chemistry are known. Between 1971 and 1974 the lake was studied more intensely than it had been before, while efforts were made to inform lakeside residents of the role of lawn fertilizers in the deterioration of the lake. The response was encouraging, with a drop from 52% of the households using phosphate lawn fertilizer in 1969 compared to 24% of the households in 1974. Even with this reduced use of phosphate fertilizers, the indications from the lake are of increasing eutrophication over that period of time. Cyclotella michiganiana, which had previously been dominant, has all but disappeared, while araphidinean diatoms have greatly increased. Certain blue-green algae that had been absent before are becoming characteristic of the area. The ratio of araphidinean to centric diatoms in recent sediments has also increased. Primary productivity and particulate and dissolved organic carbon concentrations have also increased over the years. While studies made since 1974 have indicated no further deterioration, there was also no indication of an improvement in the condition of the lake. (Baker-FRC)
W81-06197

FLUXES OF ARSENIC, LEAD, ZINC, AND CADMIUM TO GREEN BAY AND LAKE MICHIGAN SEDIMENTS,
Wisconsin Univ., Milwaukee. Dept. of Civil Engineering.
E. R. Christensen, and N-K. Chien.
Environmental Science and Technology, Vol 15, No 5, p 553-558, May, 1981. 7 Fig, 4 Tab, 36 Ref.

Descriptors: Arsenic, *Lead, *Zinc, *Cadmium, Lakes, Sediment transport, *Lake sediments, Trace metals, Metals, Air pollution, Path of pollutants, Water pollution sources, Green Bay, *Lake Michigan.

Concentrations of arsenic, lead, zinc, and cadmium were determined in sediment cores from two areas in Lake Michigan--two stations at Green Bay, site of industrial water pollution, and three stations in the north, remote from river outfalls. The northern stations accumulated trace metals (As, 10 ppm; Pb, 10-55 ppm; Zn, 40-170 ppm; and Cd, 0.8-1.8 ppm) at a rate less than or equal to atmospheric fallout rates. One station received no recent input, another received less than atmospheric inputs, and a third showed influences of air pollution from the population centers of Gary, Chicago, and Milwaukee. Sedimentation was very low (0.001 to 0.044 cm per year) for two reasons: water circulation patterns favor deposition in the south, and rivers in this area do not contribute large amounts of silt. In the Green Bay samples, sedimentation was greater, 0.084 to 0.43 cm per year, and metal concentrations in the recent (since 1918) sediment layers were higher: Pb, 30-50 ppm; Zn, 100-160 ppm; and Cd, 1.1-1.8 ppm. Arsenic was particularly high in the upper layers of one Green Bay sample, 43 ppm, a result of leaching from a former arsenical herbicide waste pile. Old sediment (1700) levels were As, 10 ppm; Pb, 10 ppm; Zn, 80 ppm; and Cd, 0.5 ppm. (Cassar-FRC)
W81-06280

HEAVY-METAL POLLUTION OF LAKES MICHIGAN, ERIE, AND ONTARIO,
Moscow State Univ. (USSR).
T. I. Kontrat'eva, and S. P. Gorshkov.
Water Resources (English Translation), Vol 1, No 1, p 81-87, January-February, 1980. Translated from Vodnye Resursy, No 1, p 177-184, January-February, 1980.

Descriptors: *Heavy metals, *Sedimentation, *Self-purification, Metals, Lakes, *Great Lakes, Water exchange, Bottom sediments, Lake sediments, Eutrophic lakes, Mesotrophic lakes, Oligotrophic lakes, Erosion, Organic matter, Accumulation, Water pollution, Fate of pollutants.

Drawing on published literature on heavy metals and sedimentation in Lakes Michigan, Erie, and Ontario, the authors prepared a graph depicting sediments accumulation, their components, and water exchange. Lake Erie, the most eutrophic and dynamic, showed the most rapid water exchange and accumulation of sediment, organic matter, and heavy metals in the sediment (Cu, V, Zn, Pb, and Hg). This lake has the greatest potential for removing heavy metals from the water into the sediments. Compared with Lake Erie, the more oligotrophic Lake Michigan had a fraction of the water exchange and sedimentation of inorganic and organic matter. Lake Michigan had the least capacity for transferring metals into bottom sediments. Intermediate between the two lakes was Lake Ontario, except for Pb and Hg accumulation, which approached that of Lake Erie. Future changes in heavy metals levels in water may be predicted. For example, if erosion decreases, metal concentrations would increase. (Cassar-FRC)
W81-06283

SIMULATION MODELING OF THE PLANKTON ECOSYSTEM OF A RESERVOIR,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
S. V. Bagotskii, and V. A. Vavilin.
Water Resources (English Translation), Vol 7, No 1, p 1-11, January/February, 1980. 5 Fig, 2 Tab, 7 Ref. Translated from Vodnye Resursy, No 1, p 30-42, January/February, 1980.

Descriptors: *Reservoirs, *Phytoplankton, Algae, Aquatic plants, Simulation, Simulation analysis, Mathematical studies, Bacteria, Biomass, Diatoms, Benthos, Domestic wastes, Agricultural chemicals, Fertilizers, Nitrogen, Phosphorus, Agricultural runoff, *Plankton, *Ecosystems.

This article presents a simulation model of the plankton ecosystem of a reservoir, investigating the changes in its seasonal dynamics as the inflow into the reservoir of domestic sewage and fertilizers washed from fields increased. The routine used to describe the reservoir is highly flexible and can be used for modeling a water body of arbitrary structure. The reservoir is assumed to consist of several reaches, in each of which ideal mixing exists. Th pools are interconnected by flows; flows to the inlet of the reservoir and flows from its outlet exist. The volume, temperature, and rate of entry of components from the bottom due to vertical mixing are calculated for each pool at each instant. One thermal pollution source can be assigned to the reservoir. The program can calculate the dynamics of biotic components overall and in individual pools. The results of calculating the seasonal dynamics for the simplest variant of the model are described in the article. This variant includes as variables diatoms, blue-green algae, bacteria, zooplankton, one fraction of organic matter, nitrogen, phosphorus, iron, and dissolved oxygen. Higher aquatic vegetation is not considered. It is assumed that zooplankton organisms feed on diatoms, bacteria, and organic matter. The dependence of the dynamics of the ecosystem on anthropogenic loads for various parameters of zooplankton feeding is the main object of consideration. The inflow of fertilizers - both nitrogen and phosphorus - occurs only during the spring. Findings indicate a linear relation between the phosphorus load and average phytoplankton biomasses. Although the mean annual and the summer stationary biomass of algae differ, it is assumed that they correlate among themselves. (Baker-FRC)
W81-06288

SPECIFIC CHARACTERISTICS OF WIND WAVES UNDER RESERVOIR CONDITIONS,
Perm State Univ. (USSR).
S. A. Dvinskikh, and Yu. M. Matarzin.
Water Resources (English Translation), Vol 7, No 1, p 57-64, January/February, 1980. 6 Fig, 2 Tab, 19 Ref. Translated from Vodnye Resursy, No 1, p 146-155, January/February, 1980.

Descriptors: *Reservoirs, *Waves, Mathematical studies, *Wind waves, Wind, Model studies, Comparison studies.

In this article an attempt is made to analyze the conditions of development of wind waves on seas and oceans in individual zones of the reservoir and to develop methods of calculating and predicting wave parameters for the example of the Kama reservoir. The specific characteristics of waves in reservoirs are due to the fact that local conditions such as morphometry of the bottom, shoreline configuration and other factors have a considerable effect on the development of waves. A complex shoreline configuration promotes the formation of various superposed wave systems, determining primarily the three-dimensional character of waves. Fluctuations of the level during filling and drawdown of reservoirs in the navigation season lead to a change in the conditions of wave formation. The presence of long broads and narrows, existence of high banks, character of vegetation on the banks, and considerable ruggedness of the shoreline each affects the wind. An analysis of wave development in the Kama reservoir is presented which shows that to a first approximation one could tentatively distinguish stages of wave development for which the wave height is a function of certain factors. More than 25,000 observations of wave parameters were used, including about 1500 simultaneous observations of wind duration, to analyze waves in the deep water zone of the reservoir. Waves on reservoirs were shown to have several characteristic differences from waves on seas and lakes. (Baker-FRC)
W81-06290

INVESTIGATION OF THE ORIGIN AND DYNAMICS OF WATERS OF LARGE LAKE BASINS BY MEANS OF NATURAL ISOTOPES,
Akademiya Nauk USSR. Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 7B.
W81-06293

EFFECT OF ANTHROPOGENIC FACTORS ON PHYTOPLANKTON AND WATER QUALITY OF THE ANGARA,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
O. M. Kozhova, and G. I. Kobanova.
Water Resources (English Translation), Vol 7, No 1, p 25-29, January/February, 1980. 12 Ref. Translated from Vodnye Resursy, No 1, p 61-66, January/February, 1980.

Descriptors: *Phytoplankton, *Reservoirs, Dams, Aquatic plants, Plankton, Algae, Ecological effects, Eutrophication, Angara River, *Siberia.

Investigations of phytoplankton populations in the Irkutsk reservoir, on the Angara River, were made in 1977. In this supplemental investigation, 30 additional species of phytoplankton were catalogued which had not been noted in that reservoir prior to this time. Among the more abundant species were Gymnodinium baicalense Ant. and its variety G. baicalense var. minor Ant., Baikal endemic species where cause water blooms in Lake Baikal in the ice-covered period. Of the yellow-green algae present, note is made of the genus Chrysococcus sp. and the genus Chromulina Cienk. Rhaphidonema longiseta Vischer. was noted as among the green algae present in large amount. Studies of the phytoplankton population between the Irkutsk and Bratsk reservoirs revealed a composition similar to that of the Irkutsk reservoir, but smaller numbers, with the concentration of benthic diatoms in the water column being considerably higher. The next reservoir on the Angara, the Bartsk, is one of the extremely large artificial water bodies. The annual maximum of phytoplankton biomass is due to the development of the summer-fall complex of algae. In the region of the Ust'-Ilim reservoir 212 specific and intraspecific taxa of algae were noted. Of these 112 were planktonic species with 20 subordinate taxonomic units. In the first year after completion of the reservoir, substantial changes occurred in the phytoplankton downstream from the Ust'-Ilim dam. (Baker-FRC)
W81-06294

ECOLOGICAL INDICATION OF WATER QUALITY IN LARGE OLIGOTROPHIC LAKES SUBJECTED TO ANTHROPOGENIC INFLUENCES,
Krasnodar Fisheries Research Inst. (USSR).
S. V. Kreneva.

Water Resources (English Translation), Vol 7, No 1, p 11-24, January/February, 1980. 6 Fig, 1 Tab, 15 Ref. Translated from Vodnye Resursy, No 1, p 43-60, January/February, 1980.

Descriptors: *Oligotrophic lakes, *Water quality, Lakes, Oligotrophy, Trophic level, Microorganisms, Plankton, Aquatic plants, *Industrial wastewater, Wastewater, Domestic wastes, Ecological effects.

The purpose of this study was to develop methods of indicating water quality for conditions of strong dilution of industrial wastewaters entering large oligotrophic lakes. The study included determination of zones with different degrees of pollution and elucidation of the ecological characteristics related to the indicator possibilities of individual plankton species. Specifically, the microzooplankton of two large lakes of the northwestern European USSR in zones subjected to the influence of industrial and domestic sewage were studied, from May through October in 1973-1975. The study revealed an increase in heterotrophic processes at sites of pollution by sewage of different origins containing organic substances. Depending on the dynamics of interaction of the wastewaters with the lake waters, different regions of a lake had high trophicity areas which were either well-defined or diffuse. In the nearshore zone of the open lake it was necessary to use statistical methods for data processing by constructing a model of the polluted region with the use of hydrophysical and hydrochemical data. Two methods of classifying water masses are proposed which are based on reducing the solution of the multidimensional problem to one-dimensional through the introduction of an integral pollution index and use of one of the algorithms of pattern recognition theory. Use of regression analysis and random balance methods permits construction of a model of the dependence of the number of hydrobionts on hydrophysical and hydrochemical indices and extrapolating the hydrobiological indices, ranking the known factors by degree of effect on groups and individual species of hydrobionts, and determination of the degree of effect of the entire set of investigated factors. (Baker-FRC)
W81-06295

PRIMARY PRODUCTION OF WATER BODIES AS A FUNCTION OF PHYTOPLANKTON CONCENTRATION AND WATER TRANSPARENCY,

Vsesoyuznyi Nauchno-Issledovatelskii Inst. Prodovogo Rybnogo Khoziaistva, Rybnoe (USSR).
S. A. Baranov.

Water Resources (English Translation), Vol 7, No 2, p 164-181, March/April, 1980. 6 Fig, 1 Tab, 50 Ref. Translated from Vodnye Resursy, No 2, p 137-157, March/April, 1980.

Descriptors: *Lakes, *Primary productivity, *Transparency, Optical properties, Photosynthesis, Phytoplankton, Aquatic plants, *Chlorophyll, Soviet Union.

The relationship between water transparency and the production of chlorophyll was investigated in an aquatic ecosystem. The properties of the standard normal curve of pelagic photosynthesis were examined and generalized. A variant of the curve was proposed which corresponds to the average conditions in the Moscow region in summer. The maximum photosynthesis was double the average, and the average was observed at the depth of disk transparency. The depth of the photic zone in the range of 14 m was equal to double the value of the disk transparency. The decrease of optical density with increase of algal concentration occurred according to the so-called surface law. A nomogram of the average values of photosynthesis in pelagic phytocenoses with a depth from 1-2 mm to 100 m was examined, and it corresponded to experimental values found in the literature. (Small-FRC)
W81-06297

IMPORTANCE OF THE WATER-LEVEL REGIME FOR RESERVOIR FISHERY,

Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
L. K. Il'ina, and N. A. Gordeev.

Water Resources (English Translation), Vol 7, No 2, p 153-164, March/April, 1980. Translated from Vodnye Resursy, No 2, p 123-136, March/April, 1980.

Descriptors: *Reservoir fisheries, *Reservoir operation, *Water level, Water level fluctuations, Drawdown, Aquatic productivity, Spawning, Soviet Union.

The role of water level in the production of fish in reservoirs is reviewed. Water level determines the formation of littoral vegetation and spawning substrates, and also determines flooding. The degree of development of vegetation determines the reproductive conditions of the fish and influences the productivity of the water body as a whole. Water level also influences the wintering conditions of fish. The most important factor for reproduction of fish stocks in reservoirs is the filling and drawdown of water level during the year. For example, in the Uglich reservoir, a constant level in summer provides for preservation of a large area of shoals and creates optimum conditions for spawning. This reservoir also maintains a high level in winter. On the other hand, the Sheksna reservoir has a small winter draw/down, and flooding in the spring leads to weakly developed vegetation in the shoal areas. The most successful fish production will be obtained when fish adapted to reservoir conditions are seeded into the reservoirs. (Small-FRC)
W81-06301

STRUCTURE OF THE WATERS AND CONDITIONS OF FORMATION OF BIOLOGICAL PRODUCTIVITY OF THE MIDDLE AND SOUTHERN CASPIAN SEA,

Moscow State Univ. (USSR).
A. N. Kosarev.

Water Resources (English Translation), Vol 7, No 3, p 214-221, May-June, 1980. 3 Fig, 1 Tab, 17 Ref. Translated from Vodnye Resursy, No 3, p 26-36, May-June, 1980.

Descriptors: *Productivity, *Water temperature, *Oxygen, Dissolved oxygen, Lakes, Nutrients, Water circulation, Wind-driven currents, Salinity, Water exchange, Seasonal variations, Phosphates, Silicon, Phytoplankton, Stratification, Runoff, *Caspian Sea, Aquatic life.

A detailed description of the wind-driven currents, mixing in the upper layer, temperatures, vertical circulation, convection, and waves in the Caspian Sea serves as a background for discussion of the relationships between abiotic and biotic environmental factors. The Southern basin and the Middle basin differ from each other in the temperatures at various levels and in the rate of spring warming, the Southern Caspian being a little warmer. Dissolved oxygen content in the mixed layers is greater by 0.5-1.0 ml per liter in severe winters than in moderate or mild winters; in deep layers, it is 2-3 and 1-2 ml per liter greater, respectively, for the Middle and Southern Caspian. A minimum oxygen content is reached at 200-400 meters depth. In the Middle Caspian, oxygen increases somewhat in the bottom layers, and in the Southern Caspian oxygen gradually decreases toward the bottom. Likewise, distribution of silicon and phosphates depends on the severity of the winter, being higher in the upper layers after severe winters than after moderate winters. The trophic system of the Middle and Southern basins is conservative compared with the Northern Basin, where substances turn over rapidly. The Middle Caspian develops phytoplankton in spring; larger amounts grow after severe winters which promote convective mixing. Unlike the Northern Caspian, the Middle and Southern basins are little affected by changes in inflow and nutrients, since their water volumes are so large. Regulation of the Volga River flow promotes transport of nutrients to the Middle and Southern Caspian, where they can nourish phytoplankton. The most favorable conditions for high biological activity in the deep basin of the Caspian are a long cold winter, sudden spring, windy summer, uniform and abundant river runoff, and stable salinity. (Cassar-FRC)
W81-06306

NUMERICAL CALCULATION OF TWO-DIMENSIONAL FLOWS IN LAKE ONEGA IN THE CASE OF WATER TRANSFER,

V. F. Baklanovskaya, Z. N. Dobrovol'skaya, P. P. Koryavov, and I. I. Chechel'.

Water Resources (English Translation), Vol 7, No 3, p 247-253, May-June, 1980. 4 Fig, 9 Ref. Translated from Vodnye Resursy, No 3, p 113-121, May-June, 1980.

Descriptors: *Water circulation, *Wind-driven currents, *Currents, *Numerical analysis, Water currents, Diversion, Water transfer, Onega Lake, USSR.

A numerical scheme for calculating two-dimensional currents in lakes and other bodies of complex configuration is presented. Lake Onega, a large freshwater lake in Russia, is used as an illustration. Variables include volumes of water transported, inflow into the lake, and wind patterns and speeds. It is not possible to draw general conclusions about the effects of diversion on lake dynamics, because this method uses a simplified wind situation (constant in time over the entire lake). However, a qualitative evaluation of currents is possible. (Cassar-FRC)
W81-06307

BALANCE OF ORGANIC MATTER, BIOGENIC ELEMENTS, AND TRACE ELEMENTS IN THE IVANKOVO RESERVOIR,

Akademiya Nauk SSSR, Moscow. Inst. of Vodnykh Problem.
A. I. Kadukin, V. V. Krasintseva, G. I. Romanova, L. V. Tarasenko, and N. V. Turunina.

Water Resources (English Translation), Vol 7, No 4, p 346-355, July-August, 1980. 7 Tab, 38 Ref. Translated from Vodnye Resursy, No 4, p 120-131, July-August, 1980.

Descriptors: *Organic carbon, *Trace metals, *Nutrients, *Input-output analysis, Reservoirs, Nitrogen compounds, Phosphorus compounds, Carbon, Copper, Iron, Manganese, Zinc, Metals, Sediments, Bottom sediments, Phytoplankton, Aquatic plants, Agriculture, Interstitial water, Path of pollutants, *Ivankovo Reservoir, USSR.

The balances of organic matter, biogenic elements, and trace elements were determined for the Ivankovo reservoir, which holds 1.12 cu km of water. Grand totals of incoming materials were 318.7 thousand tons of organic carbon, 55.15 thousand tons of total N, and 3.71 thousand tons of total P. These statistics are further divided into allochthonous material (river runoff, pollutants from various sources, farmland runoff, and precipitation) and autochthonous material (primary production, vegetation excretions, and bacterial dark assimilation of CO_2). Outflows amount to 261.7 thousand tons of organic carbon (50% runoff, 13% destruction, 12% uptake by vegetation, and 18% adsorption onto sediments); 55.07 thousand tons total N (53% absorption by phytoplankton and aquatic vegetation), and 5.43 thousand tons total P (59% absorption by phytoplankton and aquatic vegetation). The reservoir accumulates each year (in thousands of tons) organic carbon, 57%; total N, 0.13; and total P, 0.28. Concentrations of the trace elements Fe, Mn, Cu, and Zn are given for each season in 7 locations. Input and output, absorption by plants and phytoplankton, and concentrations in bottom sediments are also given for each metal. (Cassar-FRC)
W81-06309

CHANGE IN CERTAIN CHARACTERISTICS OF A STRATIFIED WATER BODY UNDER THE EFFECT OF ARTIFICIAL AERATION,

Akademiya Nauk SSSR, Moscow. Inst. of Vodnykh Problem.
V. F. Brekhovskikh, and N. S. Zolotareva.

Water Resources (English Translation), Vol 7, No 4, p 355-364, July-August, 1980. 5 Fig, 2 Tab, 34 Ref. Translated from Vodnye Resursy, No 4, p 132-143, July-August, 1980.

Descriptors: *Aeration, *Productivity, *Destratification, *Lakes, Aquatic life, Plankton, Phytoplankton, Zooplankton, Algae, *Stratification, Water

quality, Eutrophication, Hypolimnion, Dissolved oxygen, Bacteria, Oxygen, Nutrients, Sediments, Phosphorus compounds, Bottom sediments.

Artificial aeration of a small (7 ha, volume 250,000 cu meters) stratified eutrophic lake, Maloe Medvezh'e (Little Bear) Lake in the Moscow region, did not change the level of primary productivity. Aeration was done continuously for 10 days starting in mid-July 1978, 11 hours a day in August, and 5 hours a day in September. Bol-shoe Medvezh'e (Big Bear) Lake served as a control. Dissolved oxygen fluctuated noticeably, probably as a result of partial stratification. Concentration of H2S, ammonium, and BOD decreased in the hypolimnion. The pH and total P concentration remained constant. Aeration decreased the number of bacteria and increased the number of algae, protozoans, and rotifers. Numbers of some individual species changed markedly, but green algae, diatoms, and protozoans remained dominant. P concentration in surface waters decreased, and in bottom waters it remained at the pre-aeration level. The rate of oxygen uptake in the deep part of the lake changed little during aeration. In the hypolimnion the rate of destruction processes doubled during aeration. (Cassar-FRC)
W81-06310

LIMNOLOGICAL SURVEY OF EIGHT BILLABONGS IN THE MAGELA CREEK CATCHMENT, NORTHERN TERRITORY,
Caulfield Inst. of Tech., Victoria (Australia).
B. T. Hart, and R. J. McGregor.
Australian Journal of Marine and Freshwater Research, Vol 31, No 5, p 611-626, October, 1980. 4 Fig, 3 Tab, 19 Ref.

Descriptors: *Rivers, *Limnology, *Australia, Physicochemical properties, Sodium, Potassium, *Backwater, Chlorides, Phosphates, Nitrates, Chlorophyll a, Nutrients, Water quality, Temperature effects, Dissolved oxygen, Mesotrophic lakes, Lakes, *Billabongs.

The general physicochemical limnology of eight billabongs is reported from the Magela catchment in northern territory of Australia. Eight billabongs were sampled at weekly intervals during the 6 weeks from December, 1977, to January 17, 1978. Four 'backflow' billabongs, Georgetown, Coonjimba, Gulungul and Corndorl, are positioned close to where tributaries join the main Magela Creek channel, from which each is separated by a low natural levee. At the end of the dry season, the billabongs' waters had elevated conductivity and turbidity, and generally higher sodium, potassium, chloride, phosphate, nitrate and chlorophyll-a concentrations. They were generally slightly acidic and, in some, the bottom water was anaerobic. With the beginning of the wet season, the billabongs were flushed and a significant improvement was noted in water quality. Temperature, dissolved oxygen and redox potential data were used to tentatively classify these billabongs as polymictic. Under certain circumstances mixing did not occur for several days, during which time the bottom waters became significantly depleted in dissolved oxygen. On the basis of limited nutrient and chlorophyll-a data, the billabongs at the end of the dry season appear to be mesotrophic. (Baker-FRC)
W81-06378

PHYSICO-CHEMISTRY OF SURFACE WATERS IN THE CAMPINE REGION OF BELGIUM, WITH SPECIAL REFERENCE TO ACID MOORLAND POOLS,
Antwerpen Univ., Wilrijk (Belgium). Dept. of Biology.
For primary bibliographic entry see Field 2K.
W81-06387

EUTROPHICATION STUDY OF LAKE DAYLESFORD, VICTORIA,
Victoria State Rivers and Water Supply Commission, Armadale (Australia).
J. L. Bales, G. K. Curtin, I. C. Campbell, and B. T. Hart.
Australian Journal of Marine and Freshwater Research, Vol 31, No 5, p 573-587, October, 1980. 3 Fig, 5 Tab, 20 Ref.

Descriptors: *Eutrophication, *Wastewater disposal, Trophic level, Algal growth, Eutrophic lakes, *Lakes, Euphotic zone, Phosphorus, Nutrients, Chlorophyll-a, *Lake Daylesford, Victoria, Australia.

Results are reported of a survey conducted between December 1976 and October 1977 of the physicochemical and biological limnology of Lake Daylesford, Victoria, Australia. Particular aims of the survey were to identify the causes of the algal blooms known to occur during the summer months and to suggest appropriate management techniques to control these problems. Samples were taken on 10 occasions at three positions in the lake. Water quality was also measured at outlets from the lake. Surface water temperature varied from 7 to 25 degrees C. The lake was chemomictic, with stratification occurring between summer and early autumn. Surface waters were always well oxygenated, but the hypolimnion was anoxic between December 1976 and March 1977. The lake has a shallow euphotic zone 1-2 meters deep that would limit phytoplankton production. The lake was classified as eutrophic on the basis of chlorophyll-a levels, productivity, total phosphorus loadings and algal species. Chlorophyll-a levels ranged from less than 1 microgram/liter in June of 1977 to 79 micrograms/liter in February 1977. Estimated total phosphorus loading was 2.8 g P/square meter per year. The algal community was dominated by the blue-green alga Anabaena, the euglenoid Trachelomonas and the diatom Asterionella. Evidence suggests that a reduction of the phosphorus loading to the lake will do much to eliminate the annual algal blooms. Provision of sewerage facilities for the township of Daylesford may achieve the required reduction in nutrients to the lake. (Baker-FRC)
W81-06391

SEASONAL FAUNA OF EPHEMERAL SALINE LAKES NEAR THE COORONG LAGOON, SOUTH AUSTRALIA,
Adelaide Univ. (Australia). Dept. of Zoology.
P. De Deckker, and M. C. Geddes.
Australian Journal of Marine and Freshwater Research, Vol 31, No 5, p 677-699, October, 1980. 7 Fig, 2 Tab, 51 Ref.

Descriptors: *Ephemeral lakes, *Fauna, Benthic fauna, Seasonal variations, *Saline lakes, Lakes, Zooplankton, Plankton, Benthos, Crustaceans, Salinity, Australia.

Collections were made of salt-lake faunas from 23 ephemeral saline lakes in southeastern South Australia. Some occupy depressions around Lake Albert, but most lie in a corridor between two semiconsolidated calcrete-encrusted sand barriers, parallel to the southeastern coast. The Coorong lagoon occupies much of the interdune area and is connected to the sea via the mouth of the River Murray. Sampling was performed over a 10 month period during 1978-79. The numbers of species found included 16 ostracods, nine copepods, two anostracans, two cladocerans, one amphipod, one isopod, one gastropod, one nematode, one polychaete, two foraminiferans, one rotifer, and in addition ciliates, dipteran larvae, aquatic grasses and a charophyte. The number of species co-occurring in the zooplankton and epibenthos seemed particularly high. Even at salinities in excess of 100% eight species co-occurred. It does not seem that the effect of salinity on species diversity in the present study is as dramatic as in other lakes analyzed. Diversity and standing crop were very low in locality 18 at the southern end of the Coorong lagoon, but the reason for this is not apparent. (Baker-FRC)
W81-06394

BENTHIC MACROFAUNAL COMMUNITIES IN THE TUGGERAH LAKES, NEW SOUTH WALES,
New South Wales Univ., Kensington (Australia). School of Zoology.
B. J. Powis, and K. I. M. Robinson.
Australian Journal of Marine and Freshwater Research, Vol 31, No 6, p 803-815, December, 1980. 2 Fig, 5 Tab, 33 Ref.

Descriptors: *Benthic fauna, *Lakes, Tuggerah Lakes, *Australia, Floods, Thermal powerplants, Water temperature, Powerplants, Thermal power, *Thermal pollution, Heated water, Plumes, Temperature effects, *Floodwater, Ecological effects.

This paper examines differences in the structure of communities throughout the Tuggerah Lakes and attempts to relate them to variations in habitat types. A severe flood occurred during the course of the study, and its effect on these communities was also examined. Benthic macrofaunal communities were sampled using a diver-held corer. Communities were separated using DIVINF and MULCLAS classification techniques, and the structure of the communities assessed using species number, diversity and evenness indices. Community structure was closely related to habitat type, seagrass substrates providing the greatest diversity compared with both mud and sand substrates. The flood affected the mud sites to a larger extent than seagrass sites, causing a decline in both species number and diversity. The presence of a thermal power station effluent affected shallow water community structure. Munmorah power station uses lake water to cool condensers and then returns the heated water to the lake. This produces an artificial current in, and raises the water temperature of, the area around the discharge. The presence of Velacumantus australis in large numbers appears related to the warm water. (Baker-FRC)
W81-06396

2I. Water In Plants

THE BEHAVIOR OF PEACH AND PEAR TREES UNDER EXTREME DROUGHT STRESS,
Science and Education Administration, Prosser, WA. Agriculture Research Center.
E. L. Proebsting, Jr., and J. E. Middleton.
Journal of the American Society for Horticultural Science, Vol. 105, No. 3, p 380-385, May, 1980. 10 fig, 2 Tab, 5 Ref.

Descriptors: *Fruit crops, *Water stress, Water shortage, Drought, *Water requirements, Moisture stress, Moisture deficiency, Peach trees, Pear trees.

Peach and pear trees were grown without irrigation and received only 86 mm of rainfall during the growing season. Many peach trees died after experiencing leaf water potentials below -30 bars in July and August. Defoliation began in July; fruit growth was arrested, flavor was astringent, and flower buds failed to differentiate. Pear trees survived under similar conditions, although tops died back or grew poorly and flowering was reduced. Regrowth came from trunks and lower scaffolds. Heavy pruning delayed the appearance of drought symptoms until very late in the season and resulted in 100% survival of both peach and pear trees. Extensive thinning of peaches in early June did not affect the current season's symptoms, but apparently reduced dieback and death of trees. Vegetative growth in the following year was weak on the periphery of drought-injured trees. If vigorous growth occurred, it came from the trunk and lower portion of the main scaffolds. Such vigorous growth usually apeared on trees that were summer pruned or that had died back. (Baker-FRC)
W81-06165

EFFECT OF WATER STRESS ON PRODUCTION AND QUALITY OF SWEET CORN SEED,
Idaho Univ., Moscow. Dept. of Plant and Soil Sciences.
M. Chotena, D. J. Makus, and W. R. Simpson.
Journal of the American Society for Horticultural Science, Vol 105, No 3, p 289-293, May, 1980. 5 Tab, 18 Ref.

Descriptors: *Crop yield, *Water stress, Drought, Water shortage, *Corn, Stress, Soil moisture deficiency, Moisture deficiency, Water demand, Moisture stress, Plant diseases, Seeds, Water requirements.

Field experiments were conducted on 4 mid-season sweet corn inbreds in 1978 on a Greenleaf silt loam

soil. A split plot design was used, having all four inbreds nested within seven irrigation treatments. Irrigation was withheld until two levels of plant stress were noted. These levels were called moderate and high, and represented a leaf water potential (LWP) difference of two bars. Moderate stress corresponded to 88% of available soil moisture depleted at a soil depth of 65 cm. Plants in high stress treatments were exposed to an additional five days of water stress after the moderate level was reached. Immediately after reaching their respective levels of water stress, the plants were furrow irrigated. Soil moisture stress two weeks after silking was associated with a significant increase in the incidence of stalk rot symptoms 80 days after planting. Stalk rot and the percent seed-borne Fusarium moniliforme Sheld were highly correlated. Stress at silking significantly reduced both yield components and seed quality attributes. Seed size distribution was influenced by the occurrence of water deficits, while the percent marketable seed was not. (Baker-FRC)
W81-06183

AN INFLUENCE OF WATER STRESS AT DIFFERENT GROWTH STAGES ON YIELD AND QUALITY OF LETTUCE SEED,
California Univ., Riverside. Dept. of Botany and Plant Sciences.
H. Izzeldin, L. F. Lippert, and F. H. Takatori.
Journal of the American Society for Horticultural Science, Vol 105, No 1, p 68-71, January, 1980. 2 Fig, 3 Tab, 14 Ref.

Descriptors: *Crop yield, *Water stress, Drought, Water shortage, *Lettuce, Stress, Soil moisture deficiency, Moisture deficiency, Water demand, Moisture stress, Plant growth, Seeds.

Seeds of 'Calmar' lettuce were sown in a greenhouse in containers filled with a sandy loam soil of good drainage. One-third of the nitrogen together with superphosphate and potassium sulfate were mixed into the soil prior to sowing. The remaining nitrogen was applied equally three weeks after sowing and at the initiation of flowering. Plants were regularly irrigated until they had 10 to 12 leaves, at which time moisture stress studies began. Three moisture levels (-0.3, -0.8, and -5.0 bars) were imposed on lettuce plants continuously or in various combinations during vegetative and reproductive growth. Plants under intermediate water deficiencies during vegetative growth gave the highest seed yields. Seed yields were significantly reduced under severe stress conditions during either vegetative or reproductive growth. These treatments resulted in the lowest average number of seeds/seed head and seed heads/plant. Plants exposed to severe stress for extended periods had the highest average seed weights. Plants grown in adequate moisture conditions had the lowest average seed weights. Seed length, width, thickness and volume correlated with seed weight. Germination was high in all treatments, 97-100%. germination obtained from seed developed on plants in severe and intermediate water deficit treatments produced the lowest percentage of abnormal seedlings. These seedlings were also the most vigorous. Moisture levels producing the greatest number of seeds generally produced seeds of lower quality. Intermediate water deficits during vegetative and reproductive growth of lettuce plants appears to produce highest seed yields together with adequate seed quality. (Baker-FRC)
W81-06184

ROOTED AQUATIC PLANT EFFECTS ON NITROGEN BUDGETS,
DuBois and King, Inc., Randolph, VT.
For primary bibliographic entry see Field 5C.
W81-06187

FLOODING-INDUCED SOIL AND PLANT ETHYLENE ACCUMULATION AND WATER STATUS RESPONSE OF FIELD-GROWN TOBACCO,
Science and Technical Administration, Florence, SC. Coastal Plains Soil and Water Conservation Research Center.
P. G. Hunt, R. B. Campbell, R. E. Sojka, and J. E. Parsons.
Plant and Soil, Vol 59, No 3, p 427-439, 1981. 7 Fig, 39 Ref.

Descriptors: *Flooding, *Ethylene, *Wilting, *Tobacco, Plant growth substances, Soil gases, Excess water, *Soil water, Oxygen, Leaves, Water potential, Soil-water-plant relationships, South Carolina.

Ethylene formation was implicated in the wilting of field grown tobacco (Nicotiana tabacum L.) in response to flooding. Fields planted with tobacco were flooded with 0, 5, and 15 cm of water per day for 6 days. By the third day oxygen in the soil decreased to less than 9% in fields receiving water. At this oxygen level and a redox potential of less than + 150 mv, most of the soil gas samples contained some ethylene; 16% contained more than 6 ppm of ethylene. In soil air samples containing greater than 9% oxygen, 87% had less than 1 ppm ethylene. Ethylene in tobacco leaf peaked 3 days after flooding and declined to preflood levels a day later, 1 day ahead of the soil ethylene increase. Leaf water potential, stem diameter, and relative leaf water content decreased with increasing ethylene levels in the soil. Possible causes of wilting are rapid pathogenic infection, but more likely, an increase in root resistance to water entry from surrounding soil. (Cassar-FRC)
W81-06317

THE SWEDISH CONIFEROUS FOREST PROJECT,
Sveriges Lantbruksuniversitet, Uppsala.
For primary bibliographic entry see Field 2A.
W81-06377

2J. Erosion and Sedimentation

SEDIMENT YIELDS OF NEW JERSEY STREAMS,
Geological Survey, Trenton, NJ. Water Resources Div.
S. M. Hindall, and D. W. Jungblut.
Geological Survey Open-File Report 80-432, 1980. 1 Sheet, 1 Tab, 5 Ref.

Descriptors: *Sediment yield, *Streams, *New Jersey, Suspended load, Sediment transport, Sediment discharge, Particle size, Gaging stations, Sampling.

Sediment data from 76 stream-gaging sites throughout New Jersey indicate that suspended sediment yields in New Jersey streams range from less than 10 tons per square mile per year to about 700 tons per square mile per year. Sixty to 100 percent of the material transported as suspended sediment is finer than 0.062. (USGS)
W81-06075

MIXTURE THEORY FOR SUSPENDED SEDIMENT TRANSPORT,
Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Science.
D. F. McTigue.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY6, p 659-673, June, 1981. 4 Fig, 21 Ref.

Descriptors: *Sediment transport, *Model studies, Theoretical analysis, Tractive forces, Sedimentation, Streamflow, Flow, *Turbulent flow, Suspended sediments, Suspended solids.

This paper invokes the continuum theory of mixtures to examine the transport of fine particulate matter in turbulent fluid flows. Particular attention is given to the use of the continuum theory as a mechanism to balance the buoyant weight of the particles being carried in a fluid which is less dense than the particles themselves. The momentum balances for the two phases, fluid and particulate, are coupled through interaction terms that include pressure gradient and drag forces. A decomposition and averaging scheme accounts for turbulent fluctuations of the velocities and concentrations. For plane uniform flow down a slope at low concentrations, the sediment does not affect the bulk flow behavior, and the usual balance between the gravitational driving force and the gradient of the fluid Reynolds stress is obtained. This theory has identified the 'diffusion' process in terms of a correlation that arises from the decomposition and averaging of the fluid-particle interaction terms in the momentum balances. The correlation represents the effect of the drag on the particles associated with turbulent velocity fluctuations in the fluid. In the case of plane flow over a flat bed in the presence of a mean concentration gradient, it is clear that the concentration and vertical velocity fluctuations are highly correlated. The result appears to be a diffusion-like process tending to obliterate the mean concentration gradient. (Baker-FRC)
W81-06171

MINIMUM STREAM POWER: THEORY,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 2E.
W81-06173

STOCHASTIC MODELS OF SUSPENDED-SEDIMENT DISPERSION,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
C. V. Alonso.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY6, p 733-757, June, 1981. 7 Fig, 84 Ref.

Descriptors: *Sediment transport, *Stochastic process, Suspended sediments, Particle size, Mathematical models, Model studies, Literature reviews, Mathematical studies, Probabilistic process, Streamflow, Flow.

Models concerned with the movement of sediment particles in suspension are reviewed. Two distinct approaches have developed over the years. One is based on the theories of turbulent diffusion by continuous movement, while the other arose from the random walk theory of stochastic processes. Existing probabilistic methods for predicting turbulent dispersion of suspended sediments began with the diffusion by continuous movements theory and proceeded to the random walk models. All these models assume that the sediment is suspended in concentrations that are not large enough to significantly affect either the fluid velocity or the motion of the suspended particles. These are all kinematic models in that they require information on the dynamics of the dispersive medium. The theory of continuous movement can be extended to natural channels, provided the Lagrangian mean velocity remains statistically stationary. Random walk simulations depend for accuracy on knowledge of the turbulent flow characteristics. Available data are very limited and are mostly restricted to two-dimensional flows. However, this obstacle may be surmounted by using Navier-Stokes solvers when no experimental information is available. The dispersion models considered assume that discrete particles follow exactly the turbulent fluctuations. This assumption limits the permissible particle size range to silts and fine sands. However, the constraint can be relaxed by coupling the flow models to a suitable form of the equation. (Baker-FRC)
W81-06202

INVESTIGATION OF THE COMPENSATING COUNTERCURRENT IN THE SHORE ZONE,
Akademiya Nauk SSSR, Moscow. Inst. Vodynkh Problem.
I. O. Leont'ev, and N. S. Speranskii.
Water Resources (English Translation), Vol 7, No 3, p 253-260, May/June, 1980. 7 Fig, 1 Tab, 6 Ref. Translated from Vodnye Resursy, No 3, p 122-131, May/June, 1980.

Descriptors: *Wind-driven currents, *Water circulation, Water currents, Oceanography, *Shores, Lakes, Sediment tranpsort, Coastal waters, Islands.

This study concludes that in the case of a shallow depositional coast with steps, the distribution of the component of the transport velocity normal to the shore over the profile fits into a single circulation scheme. The discharge of the compensating

countercurrent in the breaker zone is directly proportional to the relative wave height, orbital speed, and square of the period. The ratio of the countercurrent velocity to the maximum near-surface orbital speed in the breaker zone is proportional to the relative height and inversely proportional to the relative depth. Although there is scatter among points on the graphs, the correlation coefficients are high enough that approximate estimates may be made. (Cassar-FRC)
W81-06286

2K. Chemical Processes

GEOCHEMISTRY OF SPRING WATER, SOUTHEASTERN UINTA BASIN, UTAH AND COLORADO,
Geological Survey, Salt Lake City, UT. Water Resources Div.
B. A. Kimball.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.00. Geological Survey Water-Supply Paper 2074, 1981. 30 p, 12 Fig, 5 Tab, 45 Ref.

Descriptors: *Geochemistry, *Springs, *Groundwater, *Chemical reactions, Phase diagrams, Thermodynamics, Mass transfer, Carbon dioxide, Aluminum, Silicates, Carbonates, Hydrolysis, Chemical potential, Mineralogy, *Utah, *Colorado, Uinta Basin, Mass balance, Spring water.

The chemical quality of water in the southeastern Uinta Basin, Utah and Colorado, is important to the future development of the abundant oil-shale resouces of the area. The report examines the observed changes in chemistry as water circulates in both shallow and deep ground-water systems. Mass-balance and mass-transfer calculations are used to define reactions that simulate the observed water chemistry in the mixed sandstone, siltstone, and carbonate lithology of the Green River Formation of early Tertiary age. The mass-transfer calculations determine a reaction path particular to this system. The early dominance of calcite dissolution produces a calcium carbonate water. After calcite saturation, deeper circulation and further rock-water interaction cause the reprecipitation of calcite the dissolution of dolomite and plagioclase, and the oxidation of pyrite; all combining to produce a calcium magesium sodium bicarbonate sulfate water. The calculations suggest that silica concentrations are controlled by a kaolinite-Ca-montmorillonite phase boundary. Close agreement of mineral-saturation indices calculated by both an aqueous-equilibrium model and the mass-transfer model support the selection of reactions from the mass-transfer calculations. (USGS)
W81-06100

STUDY OF THE COMPLEX FORMATION OF COPPER(II) BY HUMIC AND FULVIC SUBSTANCES,
Geneva Univ. (Switzerland). Dept. of Inorganic and Analytical Chemistry.
J. Buffle, P. Deladoey, F. L. Greter, and W. Haerdi.
Analytica Chimica Acta, Vol 116, No 2, p 255-274, May, 1980. 8 Fig, 4 Tab, 28 Ref.

Descriptors: *Soil organic matter, *Chemical reactions, Metals, Copper, Surface waters, Trace metals, Natural waters.

The complexation properties of soil organic matter in various types of natural water samples and of fresh waters of various origins were investigated. Copper(II) was chosen as the test ion. In the study of the complexation of copper(II) by fulvic substances, based on ion-selective electrode measurements, the influences of copper concentration (1-100 micromolar), fulvic acid concentration (2-100 ml/liter), pH (3-8), and calcium concentration (0.1-5 mM) were given particular attention. The effects of statistical errors on the measurement of the values of the complex-formation parameters were considered. These parameters were measured for various surface-water samples, aqueous soil extracts, peat water, and solutions of organic matter formed by in vitro decomposition of leaves. The findings demonstrated that the complex-formation parameters were essentially independent of source for a given type of water, particularly in the cases of surface water samples. Thus it is felt that the discrepancies sometimes noted in values quoted by different researchers are due at least in part to methods emploed in measurement. (Baker-FRC)
W81-06212

EFFECT OF PH AND URANIUM CONCENTRATION ON INTERACTION OF URANIUM (VI) AND URANIUM (IV) WITH ORGANIC LIGANDS IN AQUEOUS SOLUTIONS,
Carleton Univ., Ottawa (Ontario). Dept. of Chemistry.
W. C. Li, D. M. Victor, and C. L. Chakrabarti.
Analytical Chemistry, Vol 52, No 3, p 520-523, March, 1980. 7 Fig, 4 Tab, 19 Ref.

Descriptors: *Uranium, *Water analysis, Acidity, Chemical reactions, Humic acids, Fulvic acids, Organic matter, Sediments, Natural waters, *Hydrogen ion concentration.

The effect of pH and uranium concentration on the interaction of U(VI) and U(IV) with humic, fulvic, and tannic acids was studied using dialysis and ultrafiltration techniques. Some results on the effect of competition between EDTA and humic acid for U(VI) and U(IV) at different pHs are also reported. The interactions of U(VI) and U(IV) with organic ligands in nitrate or chloride aqueous solution have been found to be pH-dependent. The stability constants of uranium-organic complexes decreased in the order: fulvic acid, humic acid, tannic acid for U(VI), and in the order humic acid, tannic acid, fulvic acid for U(IV). Scatchard plots for the uranium-organic acid systems indicated two types of binding sites with a difference in stability constants of about 100. Ultrafiltration of uranium-humic acid complexes indicated that U(VI) and U(IV) ions were concentrated in larger molcular size fractions (greater than 5.1 nm) at pH of less than or equal to three and in smaller molecular size fractions in the range of 5.1-3.1 nm and 2.4-1.9 nm pt pH values of greater than or equal to five. (Baker-FRC)
W81-06248

ANALYSIS OF THE FORMATION OF THE HYDROCHEMICAL REGIME IN AQUIFER SYSTEMS OF THE NORHTERN DVINA DEPRESSION,
Arkhangelsk Territorial Geological Administration (USSR).
A. I. Malov.
Water Resources (English Translation), Vol 7, No 2, p 140-148, March/April, 1980. 4 Fig, 2 Tab, 3 Ref. Translated from Vodnyne Resursy, No 2, p 66-76, March/April, 1980.

Descriptors: *Potential water supply, *Estimating equations, *Aquifers, *Geochemistry, Geologic history, Chemical composition, Sands, Clays, Mathematical studies, Groundwater hydrology, Geohydrology, Dvina, USSR.

Hydrodynamic analysis was performed to establish the importance of individual factors on the formation of the chemical composition of subsurface waters in the aquifer systems of the north Dvina depression. Using this information, a scheme was proposed of the hydrogeological conditions for assessing subsurface water supplies. The North Dvina river basin is filled with Late Quaternary and Holocene sand-clay deposits in the form of thin interlayers and lenses. There are two aquifers within the depression: Quaternary arenaceoargillaceous deposits and pre-Quaternary terrigenous deposits. The main factors in the formation of the chemical composition of subsurface waters in terrigenous deposits included: expulsion of salt water during sedimentation of overlying Mikulino clays, lateral inflow of fresh water from limestones, and flow of salt water into the overlying aquifer system. Salt water flows into the Quaternary deposits from the underlying aquifer and from the White Sea. Fresh water is added by infiltration. Equations are presented for estimating the supplies of groundwater in the aquifers. (Small-FRC)
W81-06299

EFFECT OF DISSOLUTION OF ALUMINOSILICATES AND CARBONATES ON IONIC ACTIVITY PRODUCTS OF CALCIUM CARBONATE IN SOIL EXTRACTS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel).
R. Levy.
Soil Science Society of America Journal, Vol 45, No 2, p 250-255, March/April, 1981. 4 Fig, 4 Tab, 26 Ref.

Descriptors: *Soil chemistry, *Minerals, Irrigation water, Bicarbonates, *Soil water, Calcium, Magnesium, Sodium, Chlorides, Monosilicic acid, Acidity, Drainage water, Solubility.

Measurements were made of the soluble species released at two soil/water ratios to reveal the presence of soil minerals of intermediate solubility and to calculate the ionic activity product (IAP) of calcium carbonate in the soil extracts. Soluble species released included monosilicic acid, bicarbonate, calcium, magnesium, sodium, and chloride. The concentrations of all soluble species released by the two soils increased and their amounts decreased with the increase in soil/water ratio. Such a dissolution pattern could be due to the presence of minerals with an intermediate solubility, a solubility which was higher than that of sparingly soluble minerals and lower than that of very soluble salts. These minerals could be either metastable soluble aluminosilicates, soluble carbonate sulfates, or both. Both soils contained minerals of intermediate solubility. When the amounts of these minerals were small, at 1:10 soil/water ratio, the extracts of the noncalcareous soil were undersaturated in respect to any well-crystallized carbonate. Those of the calcareous soil were in equilibrium with calcite. When the amounts of these minerals increased at a 1:1 soil/water ratio, they released enough calcium and carbonate to oversaturate the extracts of the two soils in respect to calcite. The IAP of the 1:1 extracts of the noncalcareous soil was 7.99 and that of the calcareous soil was 7.76. (Baker-FRC)
W81-06321

A MACROSCOPIC BASIS FOR SOIL CHEMISTRY,
California Univ., Berkeley. Dept. of Plant and Soil Biology.
K. L. Babcock, and H. E. Doner.
Soil Science, Vol 131, No 5, p 276-283, May, 1981. 1 Tab, 11 Ref.

Descriptors: *Soil chemistry, *Water properties, Thermodynamics, Soil-water-plant relationships, *Soil water, Water potentials, Cation exchange, Adsorption, Vapor pressure.

A macrosystem treatment of the physical chemistry of ions and water in soil systems is presented and compared with the development of microsystem theories. In the past, in soil chemistry, the development of a theory for the microsystem distribution of ions and water in the vicinity of an electrostatically charged colloid particle has often entailed a use of the chemical potential and activity functions, which vary with distance from the surface of the particle over dimensions on the order of 0.5 to 20 nm. The macrosystem approach operationally defines a macroscopic exchanger or surface phase and requires a chemical potential and an activity that are uniform in the phase. These functions are directly related to the vapor pressure of each constituent in the phase. Macrosystem treatment is preferred because it provides functions that are given a thermodynamic nomenclature consistent with conventional macroscopic thermodynamics. The microsystem analysis does not. The macrosystem approach provides a macroscopic basis for the analysis of equilibria, such as those involving solid phases, cation exchange, negative adsorption, and swelling. It also provides a macroscopic foundation for the formulation and test of extrathermodynamic theories, such as the Donnan equilibrium or the diffuse layer theory. It also provides a framework for the approach to more complex problems, such as nutrient availability and weathering processes. (Baker-FRC)
W81-06322

PHYSICO-CHEMISTRY OF SURFACE WATERS IN THE CAMPINE REGION OF BELGIUM, WITH SPECIAL REFERENCE TO ACID MOORLAND POOLS,
Antwerpen Univ., Wilrijk (Belgium). Dept. of Biology.
J. H. D. Vangenechten, S. Van Puymbroeck, O. L. J. Vanderborght, F. Bosmans, and H. Deckers.
Archiv fur Hydrobiologie, Vol 90, No 4, p 369-396, January, 1981. 11 Fig, 3 Tab, 66 Ref.

Descriptors: *Acidic water, *Physicochemical properties, Physical properties, *Surface waters, *Belgium, Campine region, Chemical composition, Magnesium, Calcium, Sulfates, Sodium, Cations, Anions, Bogs, Pools.

The physico-chemical composition of acid pools in the Northern region of Belgium, known as the Campine of Antwerp, was investigated with emphasis on pH, conductivity, calcium, potassium, sodium, magnesium, carbonate, bicarbonate, sulfate, chloride, and phosphate in 53 water bodies. These waters represent very acid mire waters, as well as lakes with a pH above neutrality. While the waters of the extremely acid pH class where pH was less than 4.5 exhibited boggy characteristics, their total ionic content and composition is not comparable with literature data on equally acid bog waters. Total ionic composition and the corrected conductivity values of these moorland pools are very high, about 4 meq/liter and 190 microS/cm, respectively. Sulfate is the dominant anion in all sampled pools. Various cations appeared dominant in different waters, such as magnesium, calcium, sodium, or hydrogen. The ionic composition in water bodies of pH between 4.5 and 7.0 is closely comparable with that of extremely acidic waters. In alkaline waters, pH above 7.0, bicarbonate was the dominant anion, with calcium and sodium contributing 80% of the cationic content. The water in the moorland pools arrives as rainwater via drainage from the surroundings and/or from the rain falling directly on the surface of the mire. Nonacid lakes are fed by running water from a canal derived from the Maas river or small streams and ditches. (Baker-FRC)
W81-06387

2L. Estuaries

USER'S MANUAL FOR THE DYNAMIC (DELAWARE) ESTUARY MODEL,
Environmental Research Lab., Athens, GA.
R. B. Ambrose, Jr., S. E. Roesch, and L. J. Clark.
Report EPA-903/9-80-001, April 1980. 708 p, 13 Fig, 27 Tab, 11 Ref, 5 Append.

Descriptors: *Mathematical models, *Computer models, *Estuaries, *Delaware River, *Water quality, Forecasting, Hydraulic models, Computer programs, Saline water intrusion, Coliforms, Dissolved oxygen.

This user's manual provides the details necessary for operating two models of the Delaware Estuary which are available for use in studies of the water quality of the estuary, including forecasts of the water quality response to hypothetical wastewater control strategies. The models are the hydraulic model DYNHYD and the water quality model DYNDELA. Both are modified sub-models of the Dynamic Estuary Model. The primary task of the hydraulic model is to solve the equations describing the propagation of a long wave through a shallow water system, while conserving both momentum and volume, while the water quality model solves the equations describing the movement, decay, and transformation of a material by performing a mass balance at each junction for each time step. Listings of the models are given with a detailed description of each program and its logical structure, variable definitions, data deck sequences, and sample input/output. Test cases of salinity intrusion, dye tracer movement, fecal coliforms, and dissolved oxygen budgets are used to illustrate the applications of the DYNDELA model. (Brambley-SRC)
W81-06130

REACTION PRODUCTS FROM THE CHLORINATION OF SEAWATER,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
For primary bibliographic entry see Field 5B.
W81-06134

EFFECT OF TEMPERATURE ON ACTIVITY OF PREDATORS OF SALMONELLA TYPHIMURIUM AND ESCHERICHIA COLI IN ESTUARINE WATER,
Tasmania Univ., Hobart (Australia). Dept. of Agricultural Science.
J. McCambridge, and T. A. McMeekin.
Australian Journal of Marine and Freshwater Research, Vol 31, No 6, p 851-855, December, 1980. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Estuarine environment, *Temperature effects, Environment, Estuaries, Coasts, Thermal pollution, Salmonella, Bacteria, Escherichia coli, Bioindicators.

The survival of Salmonella typhimurium and Escherichia coli was compared in estuarine water samples kept at various incubation temperatures. Similar survival curves were exhibited by both organisms, and their presence resulted in the growth of comparable numbers of predacious microorganisms at all temperatures. Bacterial decline was found to be dependent on the presence of both bacterial and protozoan predators, the latter having a temperature optimum of 15-20 degrees C and the former being more important as the incubation temperature increased. Survival was relatively unaffected at all temperatures tested over incubation periods of 10 days. It appeared from this study that it is the combined action of a number of bacterial and protozoan predators and the effect of temperature on these predators, rather than the effect of temperature alone, which is important in the decline of E. coli and S. typhimurium in estuarine waters. Further, both E. coli and S. typhimurium, when introduced into estuarine water, follow a similar pattern of decline, indicating that E. coli is a reliable indicator of potential Salmonella sp. contamination over the range of temperatures examined. (Baker-FRC)
W81-06256

FILAMENTOUS FUNGAL PROPAGULES AS POTENTIAL INDICATORS OF SEDIMENT-DETRITUS RESUSPENSION,
South Carolina Univ., Columbia. Dept. of Biology.
T. H. Chrzanowski, and L. H. Stevenson.
Botanica Marina, Vol 23, No 4, p 251-256, April, 1980. 7 Fig, 1 Tab, 12 Ref.

Descriptors: *Fungi, *Aquatic fungi, *Estuaries, Tidal effects, Tidal marshes, Scour, Sedimentology, Suspended sediment, Detritus.

The tidal fluctuations of filamentous fungal propagules at two marsh creeks were investigated, and the levels of fungi recovered from several marsh locations were determined. Samples were collected from cross-creek sections from three boats positioned across the creeks. Surface, middle, and bottom depth samples were studied. Aliquots ranging from two to five ml were filtered onto Millipore type HA filters and incubated for five days in the dark on Martin's Rose Bengal medium. Fungi fluctuated out of phase with the tide. At low tide, maximum numbers were recovered, and at high tide minimum numbers were found. Fungi generally decreased from high recoveries in upper marsh areas to lower recoveries in the nearshore ocean waters. It may be that filamentous fungal propagules are scoured from marsh sediments and transported by receding tidal waters. Thus, fungi may be a sensitive biological indicator of the flushing of sediment components into the water column. (Small-FRC)
W81-06262

FLUX OF AROCLOR 1254 BETWEEN ESTUARINE SEDIMENTS AND WATER,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
D. J. Wildish, C. D. Metcalfe, H. M. Akagi, and D. W. McLeese.
Bulletin of Environmental Contamination and Toxicology, Vol 24, No 1, p 20-26, January, 1980. 1 Fig, 3 Tab, 12 Ref.

Descriptors: *Fluctuations, *Sediment-water interfaces, Aroclor 1254, *Estuaries, Pollution load, Industrial wastes, Organic compounds, Adsorption, Estuarine environment, Coasts, Polychlorinated biphenyls, *Aroclors.

This study examines the adsorption and desorption of a representative PCB mixture, Aroclor 1254, by various size fractions of a marine sediment over a range of salinities. Such information would be useful in relating toxicological and bioaccumulation data to estimated PCB concentrations in sea water at disposal sites. Estuarine water and deionized tap water were used. Concentrations of Aroclor 1254 in spiked water, on sediment and on centrifuge tube walls in adsorption and desorption tests reached equilibrium within two hr after spiking. Adsorption of Aroclor 1254 from sea water by sediments was influenced by sediment type. The adsorption of Aroclor 1254 by silt-clay sediments increased with salinity. In all cases studied, the concentration factors for desorption were greater than for adsorption, indicating that PCB is firmly bound to the sediment. The Freundlich exponent and K value for desorption, based on the organic carbon content of the sediment, may be of practical use in predicting PCB concentrations in the pore water of settled dredge spoil, provided that the replacement rate of pore water is slow enough to allow establishment of equilibrium conditions. It is assumed that these coefficients may apply to other sediments with different combinations of organic and inorganic components. However, further study is required to check this and to find out whether the Freundlich isotherms apply at lower concentrations of PCB. (Baker-FRC)
W81-06263

ECOLOGICAL IMPACT OF MARSHLAND RECIRCULATION DITCHES,
California Univ., Berkeley. Div. of Entomology and Parasitology.
V. H. Resh, S. S. Balling, M. A. Barnby, and J. N. Collins.
California Agriculture, Vol 34, No 3, p 39, March, 1980.

Descriptors: *Mosquitoes, *Salt marshes, Tidal marshes, Marshes, Aquatic insects, Ditches, *Recirculated water, Aquatic life, Aquatic plants, Aquatic populations, Ecosystems, Coastal marshes, *Ecological effects.

Due to increased understanding of the environmental importance of salt marshes, public concern about the fate of coastal marshes and wetlands has increased greatly during the past two decades. Marshlands in the San Francisco Bay area filter suspended sediments from rivers and streams, play key roles in nutrient cycling, support several unique plants and animals, supply oxygen to the bay waters, and influence local climate. The use of recirculation ditches to reduce the breeding habitat of mosquitoes and to increase access to these habitats by predatory fish is the major means of mosquito control conducted in many of these areas. Other consequences of ditches on marsh life must be considered. Experiments to investigate this concern include pilot studies, field sampling programs, and data analysis to be conducted over a 4 yr period. Information on tidal cycles, water table, weather patterns, and physical and chemical factors is being correlated with the results from examinations of the responses of the flora and both the vertebrate and invertebrate fauna to ditching activities. It is felt that such an approach will provide information needed by all concerned parties including mosquito abatement districts, regulatory agencies, and conservation groups so that effective planning and responsible decisions may minimize environmental disruption of the ecologically important habitats. (Baker-FRC)
W81-06264

STUDY OF THE CONDITIONS OF FORMATION OF WATER SALINITY IN RIVER MOUTHS OF ARCTIC SEAS BY MEANS OF NATURAL STABLE OXYGEN ISOTOPES,

Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. S. Brezgunov, V. K. Debol'skii, M. A. Mordasov, V. V. Nechaev, and T. V. Yakimova.
Water Resources (English Translation), Vol 7, No 2, p 149-152, March/April, 1980. 1 Fig, 1 Tab, 4 Ref. Translated from Vodnye Resursy, No 2, p 101-105, March/April, 1980

Descriptors: *Saline-freshwater interfaces, *Salinity, *Arctic, Chemical properties, Polar regions, Mixing, Ice formation, Ice breakup, Isotope studies, Oxygen, Ob Gulf, *Estuaries, USSR.

The spatiotemporal distribution of O18 and salinity was investigated in the Ob Gulf. This study was part of a research program to use natural isotopes for studying water exchange in the Arctic seas. Water was sampled from the surface and bottom layers in the northern part of the Gulf during 1976 and 1977. Samples collected during July and August had isotope composition values similar to those of the rivers running into the Ob Gulf. Samples collected during March, however, had much lower isotope values. River water also was the main influence on the salinity of the Gulf. In the Ob Gulf, river waters are mixed with sea waters whose isotopic composition and salinity differ from those of the usual ocean water. This is because the formation and melting of ice influence the salinity of surface water in the Arctic basin. The data were statistically analyzed to determine the influence of the effect of ice and thermal regimes on the water mixing. (Small-FRC)
W81-06300

BIOGENIC COMPONENT OF THE SEDIMENT BALANCE OF THE COASTAL ZONE OF THE AZOV SEA,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
D. A. Eliseev, and A. V. Prashchikin.
Water Resources (English Translation), Vol 7, No 4, p 384-392, July-August, 1980. 1 Fig, 6 Tab, 17 Ref. Translated from Vodnye Resursy, No 4, p 167-177, July-August, 1980.

Descriptors: *Coastal zone management, *Beaches, *Shellfish, *Sediments, Cockles, Environmental effects, Benthic fauna, Salinity, Water management, *Azov Sea, Multipurpose projects, Recreation.

An important factor in the successful recreational development of the Azov Sea coast is the preservation of the sandy-shell beaches. Calculations indicate that the annual contribution of cockle shells to the sea bottom is approximately nine million cu meters. An average of 1.8 tons of shell sediments are deposited on each meter of shoreline annually, but distribution is extremely nonuniform. This detritus is redistributed by wind-driven currents. Hydraulic characteristics of shell material (average particle size, settling velocity, noneroding velocity, and calculated settling velocity of shell valves) are given for seven ranges of particle sizes, 1-2 mm to 30-50 mm. Water management and construction plans should take into account the changes in species of benthic fauna which are responsible for forming beaches. (Cassar-FRC)
W81-06313

RELATIONSHIP BETWEEN CONCENTRATION OF HEAVY METALS IN MUSCLE TISSUE AND BODY WEIGHT OF FISH FROM THE SWAN-AVON ESUTARY, WESTERN AUSTRALIA,
Murdoch Univ. (Western Australia). School of Environmental and Life Sciences.
For primary bibliographic entry see Field 5C.
W81-06390

BEHAVIOUR OF IRON AND MANGANESE IN THE YARRA ESTUARY,
Caulfield Inst. of Tech., Victoria (Australia).
M. Ellaway, R. Beckett, and B. T. Hart.
Australian Journal of Marine and Freshwater Research, Vol 31, No 5, p 597-609, October, 1980. 7 Fig, 2 Tab, 26 Ref.

Descriptors: *Estuaries, *Heavy metals, Yarra River estuary, Rivers, Coasts, *Iron, *Manganese, River flow, Flow, River wash, Saline water, Chemical composition, Australia.

Processes involved in the removal of iron and manganese from, or release to, the water column in the Yarra River estuary were investigated. The estuary is rather small and well-stratified, 22 kilometers long, with depths of 2 to 10 meters. The behavior of iron and manganese appeared closely linked with the magnitude of the river inflow. When average to high river flows exist, which is the more common situation, the filterable iron is transported almost entirely in colloidal forms, with 70-80% of the filterable manganese transported in bound or non-ion-exchangeable forms. The concentration of filterable iron in surface waters decreased markedly with increasing salinity, probably due to the coagulation of colloidal forms. Concentration of filterable manganese increased between the river and the less saline upper estuary and then decreased with increasing salinity. This initial increase may be in part due to leaching of manganese from suspended matter as it first enters the upper estuary. During low river flows filterable iron and manganese concentrations increase markedly in the bottom, saline water in the estuary. The findings suggest that release of iron does occur at particular times, but is small compared with its loss. It is predicted that the Yarra estuary will act as a net sink for iron. The situation for manganese is less clear. The importance of the rather infrequent storm events in flushing deposited sediment from the estuary is not known at present. (Baker-FRC)
W81-06392

BATHYMETRIC CHANGES IN THREE ESTUARIES OF THE CENTRAL NEW SOUTH WALES COAST,
Wollongong Univ. (Australia). Dept. of Geography.
E. Bryant.
Australian Journal of Marine and Freshwater Research, Vol 31, No 5, p 553-571, October, 1980. 12 Fig, 2 Tab, 61 Ref.

Descriptors: *Estuaries, *Bathymetry, Bathythermographs, Coasts, *Australia, New South Wales, Sedimentation, Sediment transport, Sediment erosion, Accretion, Waves, Hydrodynamics, Fluid mechanics.

Infilling of estuaries with marine sediment has been suspected based on North American and European studies of continuously rising sea levels. Such infilling along the New South Wales coast has ended because sea levels have been stable there since 6500 B.P. Changes detected by bathymetric analysis for the period 1868-1974 in three estuaries on the central coast of New South Wales suggest considerable contrast due to varying estuarine dynamics and sediment availability. Changes in Botany Bay have stabilized or tended towards slight erosion, while changes within Port Jackson seaward of Bradley's Head can be linked to dredging activities this century. In Broken Bay, substantial accretion has occurred at the ocean entrance and around Brisk Bay. The former accretion can be attributed to movement of sediment landward of the 20 meter contour under waves characteristic of the present wave regime, and to availability of sediment from adjacent semicompartmentalized beaches. Such sediment movement and reservoirs do not exist on nearly so large a scale at the mouths of the other two Sydney estuaries. The latter accretion is coincident with the boundaries of marine sand intrusion up the estuary and of fluvial transport seawards. Because bathymetric changes in areas of Broken Bay affected by ocean swell can be linked to wave hydrodynamics, changes in the wave climate such as increased storminess can lead to general bottom erosion. Such changes can also exacerbate erosion within Port Jackson and Botany Bay. (Baker-FRC)
W81-06393

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SURVEY OF SERVICE BEHAVIOR OF LARGE EVAPORATIVE DESALTING PLANTS,
Little (Arthur D.), Inc., Cambridge, MA.
J. D. Birkett, and E. H. Newton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-120312, Price codes: A08 in paper copy, A01 in microfiche. Report to the Office of Water Research and Technology, April, 1981. 154 p, 11 Fig, 21 Tab, 4 Ref, 2 Append. OWRT-C-90023-S(No 9422)(1), 14-34-0001-9422.

Descriptors: *Desalination plants, *Multieffect distillaton, *Multistage flash distillation, *Corrosion, *Materials engineering, Heat exchangers, Metals, Pretreatment of water, Pumps, Saline water, Sea water, *Energy consumption, *Operating temperatures, Tubing, Productivity, Plant availability, Failure rates.

A worldwide survey was made of 68 multi-stage flash and 4 multi-effect desalination plants to obtain data on operating characteristics, efficiency, and materials behavior as a function of design, operating conditions, and age. Extensive data on tube failures, flash chamber corrosion, productivity, etc., are reported as well as energy consumption and design factors. Pretreatment methods, operating temperatures and reasons for forced outages are described. 11 figures and 80 pages of tables provide detailed raw data as well as summaries and correlations.
W81-06051

BACKWASHING REVERSE-OSMOSIS AND ULTRAFILTRATION MEMBRANES BY ELECTRO-OSMOSIS,
Office of the Secretary of the Interior, Washington, DC.
K. S. Spiegler.
U.S. Patent No 4,231,865, 4 p, 1 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 1, p 260, November 4, 1980.

Descriptors: *Patents, *Desalination, *Membrane processes, *Separation techniques, *Reverse osmosis, Semipermeable membranes, Electro-osmosis, Backwashing.

Reverse osmosis processes are well known in the field of purification of saline water. In such processes, a pressure in excess of the osmotic pressure of the saline water feed solution is applied to the feed solution separated from purified water by a semipermeable membrane. Pure water is thereby caused to permeate through the membrane to the low-pressure side of the membrane, while the salt molecules or other impurities are retained by the membrane. Efficiency of the process is often greatly reduced by compaction and deposition of impurities on the high pressure (feed solution) side of the membrane. Therefore, according to the process of the invention, the membrane is back-washed by application of an electric potential across the membrane to cause a flow of water through the membrane in a direction opposite that of the pressure-driven process. This passage of current can be performed while the pressure-driven process is interrupted, or during the process itself. The necessary flow rate of the backwashing solution is achieved by application of an electric potential between the electrodes that is sufficient to cause electroosmotic flow of liquid from the low-pressure to the high-pressure side of the membrane. The magnitude of this potential will also vary with the type of membrane, specific solutions employed, and configuration and spacing of the electrodes. (Sinha-OEIS)
W81-06146

DEVICE FOR COMPLETE DESALINATION OF WATER,
W. Keil.

U.S. Patent No 4,231,872, 5 p, 1 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 1, p 262, November 4, 1980.

Descriptors: *Patents, *Desalination, *Desalination apparatus, Water treatment, Water purification, *Ion exchange, Resins.

An apparatus for the desalination of water uses a mixed cation anion exchange resin bed and comprises a cylindrical, pressure resistant tank and a disposable cartridge containing the resin. It is positioned in the tank and seals at the sides of the cartridge for preventing leakage around the bed. The cartridge is preferably made from a lightweight, inexpensive material such as a polyolefin plastic, i.e., polyethylene. (Sinha-OEIS)
W81-06147

LARGEST REVERSE OSMOSIS PLANT IN THE WESTERN WORLD ONLINE.
Journal of the American Water Works Association, Vol 73, No 5, p 32, 34, May, 1981. 2 Fig.

Descriptors: *Desalination plants, *Reverse osmosis, *Seawater, Pipelines, Desalination, Membrane processes, Water supply, Recreation demand, Drinking water, *Florida Keys.

The largest seawater reverse osmosis plant in the Western Hemisphere will be built to serve the Florida Keys, which now depend on an antiquated 18 in. diameter pipeline from the mainland. A new 36 in. pipeline will be constructed by 1984 at the earliest, and the three mgd seawater desalination plant will help meet the resident and tourist water needs until that time. The plant will use permeators to treat seawater with approximately 38,000 milligrams/liter of total dissolved solids. Following pretreatment and treatment by a single pass through the permeators, the water will be potable and contain less than 500 milligrams/liter of total dissolved solids. Each permeator contains a million or more hollow fibers that act as membranes. Water fed into one end of the permeator circulates under pressure around the bundle of fibers, forcing the freshwater through the walls of the fibers, after which it is collected as product water. (Small-FRC)
W81-06155

ANTIFOULING BOUND-LIQUID ANION EXCHANGE MEMBRANES FOR ELECTRODIALYTIC DESALINATION OF WATER,
Moleculon Research Corp., Cambridge, MA.
A. S. Obermayer, L. D. Nichols, M. B. Allen, and J. D. Levin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-117243, Price codes: A04 in paper copy, A01 in microfiche. Final Report submitted to Office of Water Research and Technology, 1981. 64 p, 5 Fig, 19 Tab, 6 Ref.

Descriptors: *Electrodialysis, *Permselective membranes, *Membrane fouling, Membrane processes, *Anion exchange, Membranes antifouling, Electrical conductivity, Poroplastic, Rejuvenation, Resistance, *Desalination, Ion exchange resins.

This report describes the performance of POROPLASTIC films as antifouling anion-exchange membranes for water desalting by electrodialysis. The films are compared to conventional anion exchange resin membranes which, prone to fouling during processing, increase cell resistance, and slow down the electrodialytic performance. Poroplastic membranes, due to high diffusive permeabilities and the liquid organic electrolyte which they can contain, represent a promising method for reducing or eliminating the problems associated with foulant-limited membrane lifetimes. To test this concept, Moleculon has developed a membrane system in which the internal membrane phase is an organic liquid electrolyte whose ion exchange sites are free to move within the membrane but unable to enter the external aqueous phase. Natural diffusion within the membrane liquid should constantly allow fresh anionic sites to be presented at the surface minimizing or eliminating foulant buildup. Preliminary studies focused on preparation of impregnated Poroplastic films with low electrodialytic resistivities. Optimized membranes possess high electrical conductances and chloride transference numbers. Static and dynamic fouling studies were initiated and it was demonstrated that the membranes, although they eventually fouled, can be defouled by simple in-situ rejuvenation techniques. These optimized Poroplastic membranes were shown to remove salt from aqueous solutions at least as well, if not better than available membranes. In electrodialysis experiments performed on saline solutions containing foulant ions, Poroplastic membranes performed substantially better than standard membranes and thus, may be a favorable alternative to those presently marketed.
W81-06196

GIBRALTAR'S WATER SUPPLY,
South West Water Authority (England).
For primary bibliographic entry see Field 3B.
W81-06379

3B. Water Yield Improvement

GIBRALTAR'S WATER SUPPLY,
South West Water Authority (England).
M. C. Doody.
Journal of the Institution of Water Engineers and Scientists, Vol 35, No 2, p 151-154, March, 1981. 1 Tab, 2 Ref.

Descriptors: *Water supply, Water supply development, Water resources development, Water conveyance, Water storage, Rainfall, Wells, Boreholes, Desalination plants, Drinking water, Potable water, *Gibraltar.

Gibraltar is a narrow rocky peninsula at the western end of the Mediterranean Sea, at the southern tip of Spain. It has an area of about 2-1/2 square miles and is composed mainly of grey limestone. The dockyard, harbor, and most of the town are to the west of the Rock. Water collection has always been difficult. Potable water today is derived from four sources: rainfall, ground water, distillation plants, and importation. The average rainfall per year is 29 inches, which is caught and stored in underground reservoirs excavated inside the Rock. Shallow wells exist on the flat plain on the north side close to the Spanish border. Originally they produced brackish water, but now, after many exploratory boreholes through hard sandstone, they produce good water at a depth of 131 ft in limestone. The borehole water has to be softened, and it is then pumped to a blending tank. Rainwater storage accounts for 16 M gal. Groundwater boreholes yield approximately 30 M gal. Distillation plants produce 400,000 to 500,000 gal/day or about 3 M gal/week. Rainwater from storage receives only filtration through coarse stone filters, sedimentation, and chlorination before going into the distribution system. (Baker-FRC)
W81-06379

THE ROLE OF AQUATIC WEEDS IN CHANGING THE PATTERN OF ECOSYSTEMS IN KERALA,
Mar Ivanios Coll., Trivandrum (India). Dept. of Botany.
K. J. Thomas.
Environmental Conservation, Vol 8, No 1, p 63-66, Spring, 1981. 4 Fig, 11 Ref.

Descriptors: *Aquatic plants, *Aquatic weed control, *Aquatic weeds, Weeds, Ponds, Evapotranspiration, Evapotranspiration control, *India, Salvinia.

The floristic composition of aquatic vegetation growing in certain ponds in parts of Kerala was compared with those recorded as growing in the same ponds more than 20 years ago. Changes were extreme, and many once-dominant species have dwindled or disappeared. Most of the components in some ponds have been completely replaced by thick mats of Salvinia. Salvinia multiplies very rapidly, forming mats upon which secondary colonists grow, which gradually leads to the complete filling of the pond. Salvinia infestations cause considerable loss of water from water-bodies through increased evapotranspiration. If Salvinia continues to spread, it is not unreasonable to expect some of the water bodies to dry up. Physical removal of Salvinia followed by biological control such as grazing by vertebrates or invertebrates may be able to keep the spread of Salvinia in check. The harvested weed could be used for the production of fertilizer, cooking gas, or hard-boards. (Small-FRC)
W81-06397

3C. Use Of Water Of Impaired Quality

RECONNAISSANCE OF WATER AVAILABILITY AND QUALITY IN ABANDONED COAL MINES NEAR ROSLYN, KITTITAS COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
F. A. Packard.
Geological Survey Open-File Report 80-955 (WRI), 1981. 20 p, 5 Fig, 3 Tab, 14 Ref.

Descriptors: *Available water, *Groundwater, *Water quality, *Coal mines, Geology, Water supply, Drought, Irrigation, Wells, Mine drainage, Recharge, *Washington, *Kittitas County, Groundwater availability, Impaired water use.

The recoverable volume of ground water in abandoned coal mines near Roslyn, Wash., is estimated to be 20,000 acre-feet. During times of drought, pumping this water into the Cle Elum and Yakima Rivers for use in irrigation downstream should present few major water-quality problems. Wells at seven locations should be sufficient to withdraw the recoverable water from nine separate reservoirs within the mines. Under normal recharge (precipitation) conditions, these reservoirs would refill in about 6 years. (USGS)
W81-06070

3D. Conservation In Domestic and Municipal Use

A REGIONAL RESPONSE TO WATER SUPPLY EMERGENCIES,
Metropolitan Council of Governments, Washington, DC.
D. Hooker.
Journal of the American Water Works Association, Vol. 73, No. 5, p 232-237, May, 1981. 5 Fig.

Descriptors: *Metropolitan water management, *Water use efficiency, *Water shortage, Drought, Mechanical failure, Water supply, Disasters, Washington Water Supply Emergency Agreement, *District of Columbia.

The Metropolitan Washington Supply Emergency Agreement is described, which was created to accomplish coordinated areawide water conservation and curtailed water use during times of critical water shortages. The agreement deals primarily with Potomac River shortages, which could potentially affect about three million people. Although water shortages are usually caused by drought, shortages caused by mechanical failures of purification processes or shortage and distribution equipment are also provided for. The agreement has three parts: text and signature page, the Potomac River flow allocation agreement, and the water supply emergency plan. The emergency plan includes initiation, which is the responsibility of the Washington Aqueduct Division; notification; implementation, including several sets of water conservation measures; and termination. Specific actions to be taken during various emergencies including water supply shortages and water outages are carefully spelled out. (Small-FRC)
W81-06167

REGIONAL ALLOCATION OF WATER RESOURCES,
Naval Postgraduate School, Monterey, CA.

For primary bibliographic entry see Field 6C.
W81-06168

TOWN OF ARLINGTON, MASSACHUSETTS ANNUAL WATER LEAKAGE SURVEY AND REPORT ON REDUCTION OF PER CAPITA CONSUMPTION,
Massachusetts Dept. of Public Works.
R. A. Ouellette.
Journal of the New England Water Works Association, Vol 94, No 1, p 55-64, March, 1980. 2 Ref.

Descriptors: *Leakage, *Surveys, *Water loss, Electronic equipment, Costs, *Pipelines, *Water mains, Water conservation, Arlington, Massachusetts.

The town of Arlington, Massachusetts hired a pipe line testing company to perform annual leakage surveys to reduce losses from leaks which failed to surface. A portable electronic listening device that detects sound vibrations caused by water escaping from a pipe under pressure is used. No excavation is required to detect leaks, so it is a very economical method. The town furnishes a map of the system, one man who is familiar with the system, and one man with a compressor to drill test holes. All hydrants are sounded twice, then all gate valves are sounded twice. This annual leakage survey has reduced per capita consumption of water to 100 gal/day. One recent survey detected 26 leaks which were causing a water loss of 255 million gal/yr. (Small-FRC)
W81-06334

3F. Conservation In Agriculture

HYDRO-ECONOMIC ANALYSIS AND PROJECTION OF IRRIGATION WATER DEMANDS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W81-06052

OPTIMIZING IRRIGATION SYSTEM CAPACITIES,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
D. L. Martin, and J. R. Gilley.
Phase I report to Water Resources Center, January 6, 1981. 14 p, 5 Fig, 7 Ref.

Descriptors: *Irrigation programs, *Evaporation rate, *Crop yield, *Evapotranspiration, *Soil moisture deficiency, Optimal yield, computer models, Potential evaporation, Evaporation rate, Soil moisture retention, Rainfall, Transpiration, Runoff, Drainage.

Selection of the proper system capacity is critical to an efficient irrigation system. Currently this decision is made based on the maximum daily evapotranspiration (ET) rate or judgment; however, a system designed for peak use will often have excess capacity. The objectives of this study were to (1) emulate Heermann's procedure which related system capacities to maximum seasonal soil moisture depletions; (2) develop a method to estimate crop yield reduction due to limiting system capacity; and (3) compare the system capacities from 1 and 2 above to that required by conventional methods. A simulation model called CROPS was developed which performs a daily balance and helps to estimate relative crop yield and the maximum seasonal soil moisture depletion. Rainfall, irrigation, evaporation, transpiration, drainage, runoff, and stored soil moisture are considered in this model. From an inspection of the yearly values, it appears that rainfall and potential evapotranspiration are independently distributed and maximum seasonal soil moisture depletion for the 16 years simulated are normally distributed. By using the normal probability functions for each capacity simulated, the relation of net system capacity to the maximum soil moisture depletion of the traditional crop rootzone can be developed for each soil-application depth combination. The system capacity requirement and the maximum seasonal soil moisture depletion are inversely related. These data are only for the Grand Island area. Preliminary soil moisture depletion should be finalized for other areas as well. Various management practices can also be simulated to determine their effect upon yield reduction. (Atkins-Omniplan)
W81-06055

SOME CONSIDERATIONS REGARDING THE IRRIGABILITY OF SOILS IN EAST-CENTRAL ALBERTA,
Alberta Dept. of Agriculture, Edmonton. Inst. of Pedology.
For primary bibliographic entry see Field 4A.
W81-06272

CONSERVING WATER IN SPRINKLING FOR FROST PROTECTION BY INTERMITTENT APPLICATION,
Pennsylvania State Univ., University Park. Dept. of Horticulture.
K. B. Perry, J. D. Martsolf, and C. T. Morrow.
Journal of the American Society for Horticultural Science, Vol 105, No 5, p 657-660, September, 1980. 6 Fig, 9 Ref.

Descriptors: *Frost protection, *Sprinkling, *Water conservation, Wind, Agriculture.

By adjusting the application rate of sprinkling systems to existing atmospheric conditions one can conserve water and make the entire effort of sprinkling to achieve frost protection a more efficient process. The maximum off period that is tolerable should be calculated. This is the sum of the time required to freeze the applied water plys time during which the ice coated plant parts cool to the critical temperature. Values of the off period for typical frost conditions are proportional to wind speed and wet bulb temperature. Field test results indicate that intermittent sprinkling provides a method to reduce water consumption in sprinkling for frost protection. The temperature of a sprinkled blossom and corresponding application rates and pulsing cycles during a May 4, 1978 frost are graphed. The time period of most interest was between 3:30 and 4:30 AM. During the period between 3:30 and 4:00, although the sprinkling rate was adequate, the 4 min off time was too long and allowed the blossom to cool more than it could warm during the on period and subsequent freezing period. Therefore, overall cooling occurred. During the period of 4:00 to 4:40 the off time of 1.5 min did provide protection. Thus one can conclude the optimum off time to be between 1.5 and 4.0 min. A maximum time off of 2.8 min was calculated for these conditions. (Baker-FRC)
W81-06350

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

RUN HYDROGRAPHS FOR PREDICTION OF FLOOD HYDROGRAPHS,
Stellenbach Univ. (South Africa). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W81-06200

DESIGN HYETOGRAPHS FOR SMALL DRAINAGE STRUCTURES,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7B.
W81-06204

MULTI-STAGE OUTLET DESIGN OF STORM-WATER RETENTION FACILITIES,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W81-06266

THE SASKATCHEWAN NELSON BASIN BOARD STUDY IN RETROSPECT,
R. B. Goodwin.
Canadian Water Resources Journal, Vol 6, No 1, p 86-95, 1981. 3 Fig, 1 Tab, 1 Ref.

Descriptors: *Water transfer, *Water storage, *Canada, Planning, Dams, Diversion, Diversion structures, Saskatchewan Nelson Basin, Alberta, Saskatchewan, Manitoba, Feasibility studies, Economic aspects.

This retrospective review of the Saskatchewan Nelson Basin Board study, which was conducted from 1968 through 1972, discusses the purposes and uses of the study, as well as some of the major findings. The study identified 55 dams and 23 diversions that could feasibly be constructed in the Saskatchewan Nelson basin. The study quantified the effect that each proposed structure would have on the quantity of water available above and below each project and developed estimates of the cost of building and maintaining each reservoir and/or diversion in 1968 dollars. All previously proposed projects, as well as many new ones, were discussed. Combinations of projects which would best improve the water supply at each of the 18 selected study points were described. Firm flow was used as a means of comparing the relative improvement that each project would make to the river system. The 18 study points were located in Saskatchewan, Alberta, and Manitoba. Eight of the study points were of direct concern to the province of Alberta. A total of 19 sites and 11 diversions which would directly affect Alberta were evaluated. These sites and diversions were also examined in combination with other proposed projects in other provinces. The study produced a base upon which future studies could be conducted, created a catalog of feasible projects for the consideration of water users, and created a monthly streamflow base which has been computerized for use in the evaluation of future proposals. (Carroll-FRC)
W81-06269

SHORE AND FLOODPLAIN MANAGEMENT STRATEGIES IN BRITISH COLUMBIA AND WASHINGTON STATE: AN INTERNATIONAL COMPARISON,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Geography.
M. L. Barker, and W. B. Morgan.
Canadian Water Resources Journal, Vol 6, No 1, p 3-24, 1981. 6 Fig, 1 Tab, 19 Ref.

Descriptors: *Flood plain management, *Coastal zone management, Government interrelations, Federal jurisdiction, Political aspects, State jurisdiction, Water resources development, *Washington, *British Columbia, Canada, Licenses, Legal aspects.

Accelerated urbanization of the coastal areas and flood plains of Washington State and British Columbia has intensified conflicts among users of water space and adjacent uplands and has increased the potential for flood damage. Urban development in both Washington and British Columbia has been concentrated along shorelines and in coastal and inland flood plains. While the problems faced by the two political units are the same, there are major differences in the management approaches taken by the state and by the province. The basic difference in shore management approaches has been in the perception of the resource being managed. In Washington, an integrated policy has been designed to manage the overall shore resources and to regulate the various uses. In British Columbia, on the other hand, various provincial and federal agencies are assigned responsibility for management of specific resources and activities, preventing a coordinated shore management program. With respect to flood plains, both Washington and British Columbia have recently switched from reliance on structural flood controls to a more comprehensive flood plain management approach. While Washington uses the 100-year flood for flood plain management purposes, British Columbia uses a 200-year base flood, resulting in a much larger area than would be the case in Washington. In Washington, the Federal flood insurance

program has resulted in considerable Federal commitment to flood plain mapping and regulation. Primary responsibility for flood loss reduction in British Columbia lies with the province, while the Federal government participates by agreement. The Canadian federal government does not participate in flood plain land-use regulation, which is primarily the responsibility of local communities. (Carroll-FRC)
W81-06270

WATER TRANSFERS -- CANADIAN STYLE,
Inland Waters Directorate, Ottawa (Ontario).
F. Quinn.
Canadian Water Resources Journal, Vol 6, No 1, p 64-76, 1981. 1 Fig, 3 Tab, 12 Ref.

Descriptors: *Water transfer, *Canada, Interbasin transfers, Hydroelectric power, Irrigation, Flood control, Municipal water, History.

This descriptive overview of existing water transfers in Canada provides a basis for concluding that the pattern of water transfer in Canada is of a scale and character found nowhere else in the world. The total flow involved in water transfer, 159,000 cubic feet per second, is considerably greater than that of the next two leading countries, the Soviet Union and the United States, combined. A survey of water transfers in which the transferred flow does not return to the stream of origin within 15 miles of the point of withdrawal and in which the mean annual flow transferred is not less than 25 cubic feet per second or 10,000 acre-feet identified about 60 water transfers in the nine provinces. Hydroelectric projects account for about 95 percent of the total water transfer, and all major transfers were implemented with hydroelectric power generation as the dominant, if not the only, purpose. The three most recent, and also largest, projects account for two-thirds of all water transferred within Canada. Water transfers for irrigation, flood control, and municipal uses assume some importance on a regional basis. In Alberta, six of the province's nine water transfers are operated for irrigation districts. Diversion of flood flows and interbasin transfers from rivers in the Northwest Territories to Alberta for consumptive uses is currently being investigated. This situation is an exception to the Canadian water transfer pattern, which generally does not involve a north-south flow, does not divert water from better-watered to drier regions nor from less to more populated areas, and does not involve interjurisdictional conflict. (Carroll-FRC)
W81-06271

SOME CONSIDERATIONS REGARDING THE IRRIGABILITY OF SOILS IN EAST-CENTRAL ALBERTA,
Alberta Dept. of Agriculture, Edmonton. Inst. of Pedology.
W. W. Pettapiece, and A. A. Kjearsgaard.
Canadian Water Resources Journal, Vol 6, No 1, p 106-121, 1981. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Irrigation, *Alberta, *Feasibility studies, Interbasin transfers, Water transfer, Canada, Soil classification, Topography, Agricultural production, Planning.

The environmental constraints posed by a situation must be considered when planning for the development of a natural resource. Soil and climatic conditions are significant factors which must be considered in the development of agricultural industries. This study investigated the effects of these conditions on the irrigation potential of about 2.5 million hectares in east-central Alberta. Soil parameters important to irrigation potential include texture, structure, permeability, salinity, sodium content, mineralogy, pedological development, and topography. The area considered, which lies between Hanna and the Saskatchewan border, includes two principal physiographic regions. One comprises relatively smooth Solonetzic plains which have minor topographic problems but serious soil limitations in terms of irrigation potential. The other, more easterly portion, consists of uplands and plains dominated by Chernozemic soils. While topography and general elevation pose major problems, this area does have the greater amount of irrigable soils. The total area considered includes about 100,000 hectares with a fair potential for irrigation and possibly another 250,000 hectares with marginal potential. Soil limitations account for about 70 percent of the non-irrigable ratings, while topographical limitations account for only 30 percent of the rejected area. The area has about 100 frost-free days per year and the total accumulated heat units range from about 1300 C to 1700 C, with the highest values occurring in the southeast sections. Consideration of various crop requirements indicates that the climate is adequate for such crops as cereals and forages, but unsuitable or marginal for such specialty crops as sugar beets, corn, and some beans, raising serious questions regarding the justification for expenditures for irrigation. Irrigation in this area would appear to be a marginal operation, providing supplementary watering of crops already grown in the area rather than means for growing specialty crops. Interbasin water transfers for irrigation purposes do not appear to be justified in this region. (Carroll-FRC)
W81-06272

ENVIRONMENTAL MANAGEMENT CONSIDERATIONS FOR THE ASSESSMENT OF INTERBASIN TRANSFER PROJECTS IN ALBERTA,
Calgary Univ. (Alberta).
For primary bibliographic entry see Field 6A.
W81-06273

LABORATORY VERIFICATION OF A DAM-BREAK FLOOD MODEL,
Geological Survey, NSTL Station, MS. Gulf Coast Hydroscience Center.
C-L. Chen.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY4, p 535-556, April, 1980. 13 Fig, 1 Tab, 12 Ref.

Descriptors: *Flood routing, *Mathematical models, *Dam failure, Floods, Performance evaluation, Hydrographs, Flood stages, Velocity, Experimental data, Mathematical studies.

A model developed on the basis of an explicit scheme of the characteristics method with specified time intervals was verified using data on dam break flood waves collected at the US Army Engineer Waterways Experiments Station. Comparison of computed and measured stage, velocity, and discharge hydrographs at selected stations for 12 WES test conditions indicated that the smaller the size of the breach, the poorer the agreement of the computed and measured results. The disagreement may be due to poor measurement accuracy of the shallow depth and small velocity downstream of a partial breach. Computed and measured stages at the partial breach oscillated in a similar fashion after the initial rapid drop. There was a momentary, large variation in the computed velocity at the leading edge which occurred immediately after the dam break in the case of a dry bed. Close agreement between computed and measured stage, velocity, and discharge hydrographs strongly indicates that the model is valid in routing the dam-break flood wave. However, some improvement is needed. (Small-FRC)
W81-06333

STREAM RENOVATION ALTERNATIVES: THE WOLF RIVER STORY,
Wildlife Management Inst., Lawrenceburg, TN.
C. A. McConnell, D. R. Parsons, G. L. Montgomery, and W. L. Gainer.
Journal of Soil and Water Conservation, Vol 35, No 1, p 17-20, January/February, 1980. 5 Ref.

Descriptors: *Stream improvement, *Erosion, *Environmental effects, *Wolf River, Tennessee, Ecological effects, Obstruction to flow, Swamps, Aquatic habitats, Channel improvement, Riparian vegetation, Water quality.

A stream renovation project, completed in October 1979, on the Wolf River, Tennessee, removed debris and obstructions from the channel so that natural stream flow was restored with little disturbance to the environment. Hand-labor and light equipment were used to remove leaning trees and small log jams, heavy equipment for major blockages. Costs averaged $11,000 per mile for the hand-labor sections and $22,000 for heavy equipment areas. Swamps, native flora and fauna, water quality, the floodplain, and streamside vegetation were either unaffected or suffered only minor damages. The Wolf River renovation can produce only temporary benefits because the main cause of obstruction is excessive upland erosion. This must be controlled for a permanent solution. (Cassar-FRC)
W81-06335

SEASONAL FLUCTUATIONS OF PHYSICAL AND CHEMICAL PARAMETERS OF A WEIR BASIN IN A REGULATED WEST NORWEGIAN RIVER,
Bergen Univ. (Norway). Dept. of Animal Ecology.
T. Baekken, A. Fjellheim, and R. Larsen.
Nordic Hydrology, Vol 12, No 1, p 31-42, 1981. 5 Fig, 4 Tab, 17 Ref.

Descriptors: *Regulated flow, *Rivers, *Seasonal variation, Weirs, Water analysis, Oxygen, Hydrogen ion concentration, Conductance, Ions, *Norway.

Physical and chemical analyses were made of water from the river Ekso (western Norway) both before and after a weir basin was built to maintain water level. Samples were collected after regulation at the inlet and outlet of the 375 m weir basin. After regulation, the water's oxygen content was slightly reduced, while the pH remained the same. Specific conductance and the concentrations of major ions before and after the regulation were in the same range, but there was a seasonal variation after regulation. Variations found in water properties were thought to be due to water discharge, biological production, and nonspecific physicochemical relationships. Regression analyses were performed on concentrations of major ions and water discharge after regulation for the summer and the winter season. (Small-FRC)
W81-06357

THE STOKESLEY FLOOD RELIEF SCHEME,
Northumbrian Water Authority (England).
R. M. Watson.
Journal of the Institution of Water Engineers and Scientists, Vol 35, No 2, p 143-150, March, 1981. 4 Fig, 1 Tab.

Descriptors: *Flood control, Flood flow, *Flood frequency, Headwater control, Floodproofing, Floods, Stokesley.

The Stokesley Flood Relief Scheme was completed in March of 1978. The hydrological and discharge design criteria adopted for the scheme are identical with those used in the preparation of the scheme proposed in 1962 by the Wear and Tees River Board. The design discharge was to relate to a return frequency of 1 in 40 years. The more recent floods of 1967, 1968, and 1976 have confirmed the design and the most recent flood of 1976 is assessed at 1 in 25 years. Using the freeboard available it is estimated that a flood in excess of 1 in 100 years frequency could be contained. The diversion channel has, since its completion, experienced several high flows, some of which would have caused marginal flooding in the town of Stokesley. These high flows have caused minor damage to river banks, although silting of the channel is ocurring on some bends. Because of this the watercourse will require a regular desilting program to be carried out, but this was expected due to the problems encountered with silt prior to and during excavation of the new channel profiles. Cost factors are listed. (Baker-FRC)
W81-06383

4B. Groundwater Management

LEGAL ASPECTS OF GROUND WATER RECHARGE,

Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 6D.
W81-06059

CONTROL OF GROUND-WATER SALINITY, ORANGE COUNTY, CALIFORNIA,
Nebraska Univ.-Lincoln. Dept. of Civil Engineering.
M. J. Hammer, and G. Elser.
Ground Water, Vol 18, No 6, p 536-540, November-December, 1980. 4 Fig.

Descriptors: *Groundwater, *Water conveyance, *Salinity, *Groundwater recharge, Injection wells, Flow, Aquifers, Pumps, Pipes, Water table, Water supply, Aqueducts, Water transport, Percolation, Surface water, Wells, Water treatment, Reclaimed water, Orange County, *California.

Groundwater is the major source of water in Orange County, California. It is supplemented by aqueduct water purchased after treatment. The economic advantages of groundwater recharge include eliminating water treatment, minimizing the size of the pipe network needed for distribution, and reducing the need for storage reservoirs. However, use of basin aquifers as a reservoir can cause salt water infiltration as the fresh water table is lowered below sea level. Injection wells reduce sea-water intrusion. Salt accumulation in the basin is a serious long term problem. Two proposed remedies are reducing seepage of waste waters and using more water from Northern California. (Titus-FRC)
W81-06339

GROWTH OF GROUND-WATER MOUND IN RESPONSE TO RECHARGE,
Indian Agricultural Research Inst., New Delhi.
For primary bibliographic entry see Field 2F.
W81-06340

OBSTACLES TO GEOTHERMAL DEVELOPMENT.
Environmental Science and Technology, Vol 14, No 3, p 255-257, March, 1980.

Descriptors: *Geothermal resources, *Energy, Natural resources, Resources development, Financial aspects, Legal aspects, Wells, Groundwater pollution, Chemical composition, Evaluation.

Geothermal development faces legal, regulatory, financial, and environmental problems which cannot be ignored. Water pollution, minimized by reinjection usage, may be a persistent problem in direct-use applications of geothermal energy. Many geothermal fluids apparently contain sodium, chloride, sulfates, and bicarbonates in much higher concentrations than would be normally found in groundwater. Arsenic, lead, potassium, and total dissolved solids may run to very high levels in some areas. If the water is dumped on the ground as opposed to reinjecting it, possible contamination of surface waters is a problem. Total dissolved solids in well water are expected to increase from 1200 to 2000 mg/liter over 30 years in one area. Such changes could render irrigation wells that are already on the borderline unusable. An open geothermal system may actually drawn down shallow groundwater tables, drying out wells. Reinjection minimizes this problem. (Baker-FRC)
W81-06341

SUBSIDENCE IN HARRIS AND GALVESTON COUNTIES, TEXAS,
Harris-Galveston Coastal Subsidence District, Houston, TX.
R. J. Neighbors.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 107, No IR2, p 161-174, June, 1981. 7 Fig, 1 Tab, 7 Ref.

Descriptors: *Subsidence, *Pressure distribution, *Compaction, *Groundwater storage, *Flooding, Soil compaction, Aquifers, Pumpage, Wells, Surface water, Available water, Economic aspects, Cost analysis, Water supply, Water treatment, Withdrawal, Houston area, Galveston area, *Texas.

The history of groundwater withdrawal in the Houston-Galveston area is reviewed, and impacts of subsidence are discussed. Pumping groundwater for industrial use began after World War I, and grew until 1975 when conservation efforts were instigated. However, between 1974 and 1978 groundwater use for public supply increased. As a result of the extensive pumpage, the pressure in the artesian aquifers has declined. The largest area of subsidence is in the vicinity of the Houston Ship Channel at Pasadena, Texas, but the area of active subsidence in the region is expanding. Permanent inundation and increased exposure to flooding are consequences of subsidence. In addition, well casings collapse, storm drains are less efficient, and geologic faults may have been activated. A Subsidence District was established to manage the region's water resources. This District suffers because the regulations are difficult to initiate and because there is a lack of groundwater-use data. Projections indicate that subsidence will continue as an expense of growth. (Titus-FRC)
W81-06342

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

AEROSOLS GENERATED BY LIQUID SLUDGE APPLICATION TO LAND,
Southwest Research Inst., San Antonio, TX.
For primary bibliographic entry see Field 5E.
W81-06132

FIREFLY LUCIFERASE ATP ASSAY DEVELOPMENT FOR MONITORING BACTERIAL CONCENTRATIONS IN WATER SUPPLIES,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
G. L. Picciolo, E. W. Chappell, J. W. Deming, R. R. Thomas, and D. A. Nibley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-163271, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-014, April, 1981. 6 p, 4 Fig, 3 Tab. EPA-IAG-D6-0982.

Descriptors: *Bacterial analysis, *Automation, *Monitoring, *Potable water, Water quality, Drinking water, Water analysis, Assay, Filtration.

A method for rapid measurement of bacterial concentration in potable water would greatly enhance water quality maintenance and control. The firefly luciferase adenosine triphosphate (ATP) assay was adapted to an automatable flow system that, in less than 2 minutes, provided assays with sensitivity comparable with established methodology (100000 bacteria/ml). Quality controls for required reagents were established. To achieve the sensitivity necessary for bacterial measurements in water, the sample must be concentrated before assay. Filtration systems were evaluated for ability to concentrate bacteria from large volume samples rapidly, efficiently, and without damage to the organisms. Results indicate that most filtration systems tested had a limited capability to meet project criteria. Promising results (200 to 600 fold concentration and up to 88% recovery of bacteria) were obtained using hollow-fiber concentration systems modified to incorporate repeated backwash steps. (Moore-SRC)
W81-06133

MODIFICATIONS TO METHODS FOR VOLATILE ORGANICS ANALYSIS AT TRACE LEVELS,
FMC Corp., Princeton, NJ.
H. C. Hu, and P. H. Weiner.
Journal of Chromatographic Science, Vol. 18, No. 7, p 333-342, July, 1980. 5 Fig, 5 Tab, 28 Ref.

Descriptors: *Electron capture gas chromatography, *Trihalomethanes, *Wastewater analysis, Performance evaluation, Chemical analysis, Organic compounds, Trace levels.

Modifications were developed to improve the extraction method and the non-equilibrium headspace method for analyzing volatile organics in industrial wastewater. These are two of the three major methods to determine levels of tri- and tetrahalomethanes in aqueous media. Problems with severe sample foaming with industrial effluent samples and difficulty in reproducibly calibrating the system occurred with the nonequilibrium headspace procedure. A redesigning of the sparging apparatus solved these problems. The liquid-liquid extraction procedure had problems of severe gas chromatographic detector nonlinearity for samples containing mg/liter levels. Here a method is suggested to estimate the partition coefficients using the ideas developed by Hansch, and phase ratios can be adjusted to ensure that the electron capture detetor is operating in its linear range. Samples of river water, drinking water, and a time series experiment on haloform production during chlorination were measured using the two modified procedures. Either method can be used to measure microgram/liter levels of haloforms in water samples. (Small-FRC)
W81-06162

LOSSES OF SILVER, ARSENIC, CADMIUM, SELENIUM, AND ZINC TRACES FROM DISTILLED WATER AND ARTIFICIAL SEAWATER BY SORPTION ON VARIOUS CONTAINER SURFACES,
Amsterdam Univ., (Netherlands). Lab. for Analytical Chemistry.
R. Massee, F. J. M. J. Maessen, and J. J. M. DeGoeij.
Analytica Chimica Acta, Vol 127, No 1, p 181-193, June 1, 1981. 4 Tab, 41 Ref.

Descriptors: *Sample preservation, *Trace elements, *Sorption, *Pollutant identification, Silver, Arsenic, Cadmium, Selenium, Zinc, Metals, Heavy metals, Seawater, Water analysis.

Sorption of the trace elements Ag, As, Cd, Se, and Zn at levels of 10 to the minus 7th power was studied in distilled water and artificial seawater during storage in containers made of borosilicate glass, high pressure polyethylene, and polytetrafluoroethylene. Special attention was paid to the effect of the ratio of inner container surface to sample volume, R. The effects of pH (1,2,4, and 8.5) and storage time (1 min to 28 days) were also considered. A table lists sorption data from the literature for 41 elements at trace levels. As and Se showed little tendency to be sorbed. Ag, Cd, and Zn, which form partly dissociated oxy acids, showed varying degrees of sorption, especially at pH over four. In general, losses increased with increasing R values. Better sample storage results can be obtained by shortening storage times, acidification with strong acid, and reducing specific surfaces. (Cassar-FRC)
W81-06190

DETERMINATION OF NG PER ML LEVELS OF PHOSPHORUS IN WATERS BY DIISOBUTYL KETONE EXTRACTION AND INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROMETRY,
National Research Institute for Pollution and Resources, Tokyo (Japan).
A. Miyazaki, A. Kimura, and Y. Umezaki.
Analytica Chimica Acta, Vol 127, No 1, p 93-101, June 1, 1981. 3 Fig, 5 Tab, 15 Ref.

Descriptors: *Phosphorus, *Water analysis, Pollutant identification, Chemical analysis, Wastewater analysis, Seawater.

Phosphorus can be determined at the nanogram per ml level in water by reacting it with a reagent prepared with ammonium heptamolybdate and antimony potassium tartrate and extracting the product with diisobutyl ketone. P is determined by inductively coupled plasma atomic emission spectrometry at the P I 215.91 nm line. The Mo II

213.61 nm line interfered with the P I 213.62 nm line. Arsenic (3+), Si, Ge, Fe(3+), and most anions did not interfere, but As(5+) at greater than 10 x P concentrations caused positive errors. The method applied to seawater, river water, and seawater polluted with industrial wastewater and municipal sewage (0.2 micrograms per 500 ml water) gave results which agreed with results from a spectrophotometric method. The detection limit was 0.37 ng P per ml, and the relative standard deviation for 5 micrograms P was 2.1%. (Cassar-FRC)
W81-06191

THE RELIABLE DETERMINATION OF MERCURY TRACES IN SEA WATER BY SUBTRACTIVE DIFFERENTIAL PULSE VOLTAMMETRY AT THE TWIN GOLD ELECTRODE,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.).
L. Sipos, H. W. Nurnberg, P. Valenta, and M. Branica.
Analytica Chimica Acta, Vol 115, p 25-42, March, 1980. 8 Fig, 2 Tab, 55 Ref.

Descriptors: *Seawater, *Mercury, Water analysis, Chemical analysis, Heavy metals, Voltammetry, *Electrodes.

Sea water samples were collected from the surface zone and from the ocean depths of several thousand meters. The method of analysis used consisted of cathodic deposition under programmed polarization with intermittent short anodic pulses to strip the co-deposited copper usually present in sea water in substantially larger amounts than mercury, subsequent medium exchange to 0.1 M HC104 - .0025 M HCl, and differential pulse anodic stripping in the subtractive mode at a twin gold disc electrode system. The construction of the twin gold electrodes and the cell is shown. Before each measurement the twin gold electrodes must be activated. The development of the voltammetric procedure was preceded by tests to establish the most suitable electrode material and voltammetric mode. The primary aim was to develop a reliable and sufficiently sensitive approach for the determination of mercury in sea water by employing the differential pulse mode available in all modern advanced commercial polarographs. The gold electrode was found to be the best. The voltammetric procedure is now used in routine applications to extensive field studies on toxic trace metal inventories in open ocean and coastal waters. In an exploratory case study on the level of dissolved mercury at 20 stations distributed along the German North Sea coast, average levels of mercury were found to be between 5 and 20 ng/liter. More extensive monitoring of mercury levels is called for due to the high toxicity of this metal. (Baker-FRC)
W81-06192

POTENTIOMETRIC TITRATION OF TRACE AMOUNTS OF MERCURY AFTER A PRELIMINARY SEPARATION BY A REDUCTION METHOD,
Warsaw Univ. (Poland). Dept. of Chemistry.
S. Rubel, and M. Lugowska.
Analytica Chimica Acta, Vol 115, p 349-354, March, 1980. 1 Fig, 4 Tab, 12 Ref.

Descriptors: *Mercury, *Water analysis, Chemical analysis, Potentiometers, Dithiooxamide, Titration, Heavy metals.

Isolation and concentration of mercury by reduction of mercury(II) with acidic tin(II) chloride solution and absorption of mercury vapor in acidic permanganate solution is combined with potentiometric titration with dithiooxamide. Given the conditions of potentiometric determination, the most suitable of the reagents recommended for mercury absorption seems to be nitric acid. However, when tried, solutions of nitric acid did not yield quantitative absorption of mercury vapor, regardless of the acid concentration or the air flow rate. Therefore the use of acidic permanganate solution was tried, and a suitable reductant for the excess of permanganate was sought. The overall efficiency of mercury separation depended on the flow rate of the carrier gas, time and temperature. Results indicated that 10 micrograms mercury could be recovered quantitatively in 10 min, whereas complete recovery of 30 micrograms required 20 min. At this point variations in temperature and its effects on separation time were investigated. It was concluded that the coupling of the reduction-separation method with potentiometric determination of mercury made analysis possible at the ppb level. The method was very selective and allowed quantitative separation of mercury from silver, copper, iron and arsenic and from lead, zinc, cadmium, and nickel. Moderate amounts of iodide and bromide ions had no effects. At 55-60 C, 5-100 micrograms mercury could be separated from 1-cu dm samples in less than 10 minutes. The method can be applied directly for solutions containing inorganic mercury and phenylmercurials. Determination of mercury in alkylmercurials requires prior mineralization. (Baker-FRC)
W81-06207

THE DETERMINATION OF COPPER, LEAD AND CADMIUM IN AN OYSTER HOMOGENATE BY ANODIC STRIPPING VOLTAMMETRY,
Oslo Univ. (Norway).
W. Lund, and P. Sagberg.
Analytica Chimica Acta, Vol 115, p 337-341, March, 1980. 1 Fig, 2 Tab, 10 Ref.

Descriptors: *Metals, *Mollusks, *Oysters, Copper, Cadmium, Lead, Chemical analysis, Anodes, Voltammetry, Bioindicators, Heavy metals.

Samples of a homogenate from oysters collected near Sete, France, were digested using nitric acid and perchloric acid. A 25-ml aliquot of the digested and diluted sample was transferred to the electrolytic cell and deaerated for 15 min with nitrogen. A fresh mercury drop was extruded, the stirrer started, and electrolysis proceeded for 5 min at -0.8 V vs. Ag/AgCl. The stirrer was stopped, and the differential pulse anodic stripping voltammogram was recorded after a rest period of 30 sec. The following instrument settings were used: scan rate of 5 mV/sec, pulse repetition time of 0.5 sec, and modulation amplitude of 50 mV. The scan was stopped for 30 sec and the instrument sensitivity changed between the lead and copper peaks. A second and eventually a third voltammogram were recorded before small volumes of the standard solutions were added (about 50 microliters). Voltammetric measurements were then repeated and the concentrations determined by the method of standard addition. It is noted that the accuracy of the results obtained by this technique depends on the completeness of the digestion step. (Baker-FRC)
W81-06208

POTENTIOMETRIC TITRATION OF TRACE AMOUNTS OF MERCURY WITH DITHLOOXAMIDE,
Warsaw Univ. (Poland). Inst. of Fundamental Problems in Chemistry.
S. Rubel, and M. Lugowska.
Analytica Chimica Acta, Vol 115, p 343-347, March, 1980. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Mercury, *Potentiometers, Dithiooxamide, Titration, Heavy metals, Potentiometric level, Water analysis, Chemical analysis, Wastewater analysis.

A simple method has been developed to be applied to waters and wastes even in small laboratories for the determination of trace amounts of mercury. The method employs titration with dithiooxamide in potassium hydrogen phthalate medium (pH 5-6) and is suitable for the determination of mercury in concentrations above 0.05 ppm. The precision in the range 0.05-1.0 ppm Hg is about 4%. Significant amounts of sulfate, nitrate, zinc, cadmium, and lead ions can be tolerated, and small amounts of nickel, cobalt, and aluminum can be present. However, iron(III), copper(II) and silver interfere. The shapes of the titration curves make it advisable to use the first derivative for end-point determination. When the concentration of the titrant is below 5 times 10 to the minus 5th power mol/cu dm the titration curves are very indistinct. (Baker-FRC)
W81-06209

3-HYDROXYPYRIDINE-2-ALDEHYDE 2-PYRIDYLHYDRAZONE AS AN ANALYTICAL REAGENT FLUORIMETRIC DETERMINATION OF ALLUMINUM IN NATURAL WATERS,
Sevilla Univ. (Spain). Dept. of Analytical Chemistry.
J. M. Cano-Pavon, M. L. Trujillo, and A. Garcia De Torres.
Analytica Chimica Acta, Vol 117, p 319-327, June, 1980. 5 Fig, 2 Tab, 26 Ref.

Descriptors: *Aluminum, *Fluorometry, Water analysis, Chemical analysis, Spectrophotometry, Photometry, Seawater, Natural waters.

The analytical possibilities of a new reagent, 3-hydroxypyridine-2-aldehyde 2-pyrridylhydrazone (3-OH-PADH), are reported and compared with those of other N-heterocyclic hydrazones. A fluorimetric method is described for the determination of aluminum, and its application to the determination of trace quantities of aluminum in water is discussed. The results indicate that 3-OH-PAPH is very suitable for the rapid fluorimetric determination of aluminum in natural waters. The procedure is faster than the lumogallion procedure, while the interference levels are similar. Interference of beryllium is small. Sensitivity is similar to methods involving chelation of aluminum and gas chromatography or atomic-absorption spectrometry and is far greater than those of classical spectrophotometry. The determination with 3-OH-PAPH is very easy in sea water, as salt has no effect on the results. (Baker-FRC)
W81-06210

IMPROVED INSTRUMENT FOR MERCURY DETERMINATION BY ATOMIC FLUORESCENCE SPECTROMETRY WITH A HIGH-FREQUENCY ELECTRODELESS DISCHARGE LAMP,
Consiglio Nazionale delle Ricerche, Pisa (Italy).
R. Ferrara, A. Seritti, C. Barghigiani, and A. Petrosino.
Analytica Chimica Acta, Vol 117, p 391-395, June, 1980. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Mercury, *Water analysis, Seawater, Chemical analysis, Fluorescence, Spectrometers, *Atomic fluorescence spectrometry.

An instrument is described, including a mercury radiofrequency electrodeless discharge lamp, which is used for determining mercury at nanogram levels. In the atomic fluorescence spectrometry process described, the gold trap is used for removing traces of mercury present in the argon. In order to obtain high sensitivity, the light source must be intense and stable, independently of the line width, over the frequency range of maximum absorption. The source in this study provided an emission intensity approximately 100 times higher than that of a pen lamp at 253.7 nm. The radiofrequency excitation provided excellent stability of both wavelength and intensity. The system as described was used for the determination of mercury in sea water. Reactive and total mercury were measured in samples collected in the coastal waters of Tuscany, Italy. Ionic mercury in the range of 0.5-50 nm was recovered by passing nitrogen at 1 liter/min for 10 min through 500 ml samples, after addition of the mixture of tin(II)chloride and mercury-free sulfuric acid. For this volume of sample, memory effects were noted for lower gas flows and aeration times. Concentrations in the range of 0.4-9.1 ng/liter for reactive mercury and 1-30 ng/liter for total mercury were measured in sea water samples. The detection limit of the method was 0.01 ng of mercury. (Baker-FRC)
W81-06211

A CONTINUOUS-FLOW, ISOTOPE-DILUTION METHOD FOR STUDIES OF ADSORPTION BEHAVIOUR OF METAL IONS,
Birmingham Univ. (England). Dept. of Chemistry.
E. Hartmann, and K. Randle.

Analytica Chimica Acta, Vol 116, No 2, p 275-287, May, 1980. 7 Fig, 2 Tab, 9 Ref.

Descriptors: *Metals, *Adsorption, Chemical reactions, Radioisotopes, Radioactivity techniques, Cations, *Radiochemical analysis, Mercury, Humic acids.

The practicability of combining isotope dilution and the continuous-flow stirred-cell method for studying the adsorption behavior of metal ions was investigated. An on-line analysis procedure for studying metal ion-soil organic matter binding mechanisms is described. The basic principle of the method is that the count rate of a radioactively labelled metal ion solution is directly proportional to its metal ion concentration. Therefore, measuring the activity of a small volume of liquid leaving the ultrafiltration cell and comparing it with the activity of the reservoir solution containing a known amount of the metal ion gives a direct measure of the metal ion concentration in the effluent. The major practical problem involved is the shielding of the gamma-ray detector from all activity other than that arising from a very short section of the exit tube viewed by the detector. Shielding problems are much less severe with isotopes that emit beta-particles only. The technique showed potential as a rapid and accurate method for the study of adsorption behavior. One possible major advantage over other methods is the potential for study of systems containing more than one adsorbate, particularly as wash curves are produced directly for each element as the experiment proceeds. (Baker-FRC)
W81-06213

A TRANSIENT CURRENT MONITORING AND ELECTRODE CHARACTERIZATION SYSTEM FOR A PULSED OXYGEN ELECTRODE,
Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
K. D. Wise, R. B. Smart, and K. H. Mancy.
Analytical Chimica Acta, Vol 116, No 2, p 297-305, May, 1980. 6 Fig, 3 Tab, 12 Ref.

Descriptors: *Dissolved oxygen, *Water analysis, *Electrodes, Wastewater analysis, Natural waters, Oxygen, Chemical analysis.

An instrumentation system is described which was developed to provide an accurate technique for electrode characterization by using the pulsed potential method. This will provide a higher sensitivity in a portable system for field measurements of oxygen in natural and waste waters, biological fluids, cells, tissues, and non-aqueous media. The new instrumentation system is based on complementary metal oxide-silicon technology for the characterization of the pulsed oxygen electrode. The system provides the necessary timing, analog-to-digital conversion, and digital display of the transient current. This design was based on the need for independent control over the pulse amplitude, duration, and frequency (interpulse interval). The monitoring instrumentation as devised was shown to be very useful for pulsed electrode characterization. It has eliminated the need for using an oscilloscope to record transient current, making it portable and suitable for field measurements. (Baker-FRC)
W81-06214

A CRITICAL COMPARISON OF STUDIES OF COMPLEX FORMATION BETWEEN COPPER(II) AND FULVIC SUBSTANCES OF NATURAL WATERS,
Geneva Univ. (Switzerland). Dept. of Inorganic and Analytical Chemistry.
J. Buffle.
Analytica Chimica Acta, Vol 118, No 1, p 29-44, July, 1980. 4 Fig, 1 Tab, 21 Ref.

Descriptors: *Chemical reactions, *Water analysis, Electrodes, *Fulvic acids, *Copper, Chemical analysis, Natural waters, Comparison studies.

A comparative examination is presented of the results of various studies concerned with complex formation between copper(II) and fulvic substances in natural waters. Particular attention is given to results obtained in the natural pH range of 6-9. Complexation appears to depend on the concentration of fulvic compounds in a non-linear manner, such that the complexation data for concentrated solutions cannot be extrapolated to obtain information for dilute solutions by simply using an arbitrarily defined stability constant for a 1:1 complex. For interpretation of complexation data under natural water conditions, the possible formation of precipitates of the hydrolyzed metal must be taken into account. It also became apparent that, for the interpretation of the complexation in natural systems, a detailed knowledge of the possible formation of 'classical' mixed ligands in natural waters is of prime importance. This review has indicated the need for additional studies of the complexing properties of fulvic acids at pH values greater than 7.0 and showed that a rigorous interpretation of the data must take into account the posible association of fulvic acids and the formation of Cu-ligand complexes and mixed ligand complexes. (Baker-FRC)
W81-06215

DETERMINATION OF SELENIUM(IV) BY DIFFERENTIAL PULSE POLAROGRAPHY OF 4-CHLORO-O-PHENYLENEDIAMINE PIAZSELENOL,
Southampton Univ. (England). Dept. of Chemistry.
A. G. Howard, M. R. Gray, A. J. Waters, and A. R. Oromiehie.
Analytica Chimica Acta, Vol 118, No 1, p 87-91, July, 1980. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Selenium, *Polarography, Water analysis, Chemical analysis, Rivers, River Itchen, England, Seawater, Piazselenols.

The determination of 'inorganic' selenium(IV) compounds by differential pulse polarography is described. The application of this procedure to the analysis of polluted waters is considered. Initial studies were made of the polarographic behavior of several piazselenols, with 4-chloro-o-phenylenediamine being selected for the study. The piazselenol solutions were prepared by the addition of microliter quantities of the selenium(IV) stock solution to 2.5 ml of the complexing agent solution, and the mixture was made up to 50 ml with pH 2.5 buffer solution. Solutions then stood for one hour and were degassed with nitrogen prior to obtaining differential pulse polarograms of the piazselenol solutions. At pH 2.5 in formate buffer, the piazselenol gave two reduction peaks with peak potentials of -0.11 V and -0.63 V vs. SCE. at -0.11 V, the detection limit for selenium is 0.4 ng/ml. Interferences from chromium(VI), copper(II), molybdenum(VI), nickel(II), tin(II), tellurium(IV), and vanadium(V) can be overcome by treatment of the sample with a chelating resin. The method is applicable to the determination of selenium(IV) in strongly saline solutions. Initial studies demonstrated that the level of selenium(IV) present in local sea water near Southsea, Hampshire, was low. The method was also used to study selenium(IV) content of filtered samples of water obtained from the River Itchen in Hampshire. Selenium content ranged from less than 4.0 to 19.2 micrograms per liter. (Baker-FRC)
W81-06216

THE USE OF ION-SELECTIVE ELECTRODES IN MANUAL AND COMPUTER-CONTROLLED FLOW INJECTION SYSTEMS,
Netherlands Energy Research Foundation ECN, Petten.
J. Slanina, W. A. Lingerak, and F. Bakker.
Analytica Chimica Acta, Vol 117, p 91-98, June, 1980. 8 Fig, 3 Tab, 4 Ref.

Descriptors: *Electrodes, *Chemical analysis, Rain water, Surface waters, Water analysis.

The performance of ion-selective electrodes in a flow injection system under manual or active computer control is discussed, with the aim of using them for the analysis of rain and surface waters. The response of the fluoride-selective membrane electrode was not Nernstian, and depended on several parameters. When standardization methods were taken, the results of the studies were very satisfactory. Precision was typically three percent. In the course of one hour, 60 determinations are posible in the concentration range of 20-200 ppb. Detection limits of the electrodes are below the values found in other measurement modes. (Baker-FRC)
W81-06217

SORPTION OF ARSENIC, ANTIMONY AND BISMUTH ON GLYCOLMETHACRYLATE GELS WITH BOUND THIOL GROUPS FOR DIRECT SAMPLING IN ELECTROTHERMAL ATOMIC ABSORPTION SPECTROMETRY,
Pure Chemicals Research Inst., Brno (Czechoslovakia).
Z. Slovak, and B. Docekal.
Analytica Chimica Acta, Vol 117, p 293-300, June, 1980. 5 Fig, 4 Tab, 8 Ref.

Descriptors: *Arsenic, Water analysis, Spectral analysis, Photometry, Spectroscopy, *Atomic absorption spectrophotometry, *Bismuth, *Antimony.

Optimizations of the sorption of arsenic, antimony, and bismuth on Spheron Thiol and the electrothermal atomic absorption spectrometry determinations of these substances are described. Batch sorption of arsenic, antimony, and bismuth from solutions in 1M sulfuric acid has distribution coefficients of 10 to the 4th power to 10 to the 5th power. Quantitative sorption on the hydrophilic methacrylate gel containing thiol groups (Spheron Thiol) is possible within 60 min for bismuth or arsenic and 120 min for antimony. Sensitivities possible are 3.2 ng arsenic/ml, 13 ng antimony/ml and 2.8 ng bismuth/ml. The coefficient of variation for 10 ng arsenic is 4%. Complete recovery of 40 ng arsenic/ml added to solutions of 5% KCl or 5% MgC12 and to river water was obtained. (Baker-FRC)
W81-06218

APPLICATION OF EDTA TO DIRECT GRAPHITE-FURNACE ATOMIC ABSORPTION ANALYSIS FOR CADMIUM IN SEA WATER,
National Research Council of Canada, Halifax (Nova Scotia). Atlantic Regional Lab.
R. Guevremont, R. E. Sturgeon, and S. S. Berman.
Analytica Chimica Acta, Vol 115, p 163-170, March, 1980. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Seawater, *Cadmium, Chemical analysis, Water analysis, Metals, Spectral analysis, *Atomic adsorption spectrophotometry.

The direct determination of cadmium in undiluted sea water by graphite-furnace atomic absorption spectrometry is described. EDTA was added to the undiluted sea water as a matrix modifier. This addition, in combination with selective volatilization techniques, allowed cadmium to be determined by direct-injection atomic absorption spectrometry. The method is reliable, rapid, sensitive, accurate, precise, and free from random contamination problems. Only small volumes of sea water are required, usually 20 ml for 4 or 5 replicate standard addition analyses, and the response is not dependent on the chemical form of the analyte. This means it is not necessary for added ionic spikes to equilibrate chemically with the sample prior to analysis. Addition of EDTA (1.2 mg/l) to a cadmium solution (0.8 micrograms per liter) in deionized water doubled the sensitivity for cadmium. The kinetics of atom formation were obviously altered by EDTA. The contribution to the cadmium concentration by the added EDTA was about 0.05 micrograms per liter. The cadmium absorbance peak in sea water containing EDTA appears near 700 degrees C, which is well resolved from background molecular absorption by the salt matrix and EDTA decomposition products. (Baker-FRC)
W81-06219

DETERMINATION OF VERY LOW LEVELS OF INORGANIC AND ORGANIC MERCURY IN NATURAL WATERS BY COLD-VAPOR ATOMIC ABSORPTION SPECTROMETRY

AFTER PRECONCENTRATION ON A CHELATING RESIN,

Akita Univ. (Japan). Dept. of Public Health.
K. Minagawa, Y. Takizawa, and I. Kifune.
Analytica Chimica Acta, Vol 115, p 103-110, March, 1980. 6 Fig, 2 Tab, 15 Ref.

Descriptors: *Water analysis, *Mercury, Heavy metals, Lakes, Rivers, Rain, Chemical analysis, *Atomic absorption spectrophotometry, Spectrometers.

The use of chelate resin preconcentration for the simultaneous determination of traces of inorganic and organic mercury in fresh water is described. This resin contains dithiocarbamate groups which bind strongly with mercury but not with alkali and alkaline earth metals. Both forms of mercury can be collected from pH 1 to 11. Collected mercury is readily eluted with a slightly acidic aqueous 5% thiourea solution. The resin can then be reused. This method offers the advantages of using large volumes of water sample and of determining organic and inorganic mercury at ng/liter levels. The detection limit of the method is 0.2 ng/liter for both forms of mercury. In experiments analyzing lake and river waters, 35-60% of the mercury present existed as organic compounds or in association with organic matter. In rain water, only about 6% of the mercury was in this form. At present, the identity of the chemical species making up the organic mercury portion has not been established. (Baker-FRC)
W81-06220

LABELING THE MANGANESE IN GEOCHEMICAL MATRICES BY NEUTRON ACTIVATION,

Oregon State Univ., Corvallis. School of Oceanography.
A. R. Flegal.
Analytica Chimica Acta, Vol 116, No 2, p 359-364, May, 1980. 1 Fig, 3 Tab, 14 Ref.

Descriptors: *Manganese, *Estuarine environment, Chemical reactions, Chemical analysis, Water analysis, *Neutron activation analysis.

The magnitude of the Szilard-Chalmers effect is reported for three geochemical matrices containing non-labile forms of manganese. The fraction of labile manganese in another geochemical matrix containing measurable fractions of both labile and non-labile forms of manganese is also reported and compared to the fraction determined by an alternative, stable element technique. Additionally, the cationic form of the labile Mn-56 in the latter matrix is confirmed by data on its elution through a chelating resin. Data indicate that the tracing of the phase transformations of particulate manganese in estuarine zones by neutron activation of the element in geochemical matrices provides a sensitive and accurate method of following the labile forms of particulate manganese, despite the potential for isotopic disequilibria produced by the Szilard-Chalmers effect. The applicability of this n.a.a. radiotracer technique is dependent on the proposition that the specific activities of the labile and non-labile forms of manganese produced by the thermal neutron activation of geochemical matrices are the same. Mn-56 and Mn-54 may be used simultaneously to study fluxes from and to particulate phases in the estuarine zone. Specifically,the manganese in sediments may be labeled with Mn-56 by neutron activation to trace fluxes from particulate phases in the estuarine zone; and the cationic manganese in the dissolved phase may be spiked with Mn-54 in order to trace fluxes to particulate phases simultaneously. (Baker-FRC)
W81-06221

DETERMINATION OF TRACE AMOUNTS OF SOME PHENYLAMIDE PESTICIDES BY RESONANCE RAMAN SPECTROMETRY,

Tokyo Univ. (Japan). Dept. of Industrial Chemistry.
S. Higuchi, O. Aiko, and S. Tanaka.
Analytica Chimica Acta, Vol 116, No 1, p 1-6, April, 1980. 4 Fig, 2 Tab, 12 Ref.

Descriptors: *Pesticides, *Chemical analysis, Trace levels, Resonance, *Raman spectrometry, Spectral analysis.

The resonance Raman spectrometric determination of some phenylamide pesticides in waters is described. The report demonstrates that resonance Raman spectrometry may become a useful method of trace analysis in view of its high sensitivity, the shapes of the analytical curves, the influence of coexistent components, the additivity of intensities, and its excellent selectivity. A JASCO Model J-800 laser Raman spectrophotometer was used for the measurement of spectra. The samples studied included monuron, diuron, alpha-naphthylacetamide and beta-naphthylacetamide. The derivatization involved hydrolysis of the amide to the amine. The amines were diazotized and coupled with 1-naphthol to transform them into the colored products, the azo dyes. All colored product solutions exhibited abosrption bands at about 500 nm with maximum molar absorptivities from 1.9 times 10 to the 4th power to 3.1 times 10 to the 4th power liters/cm/mol. Even for closely related molcules identification is possible from these spectra. The detection limits in resonance Raman spectrometry are limited by the background intensities from the sample solutions. However, the results obtained demonstrate the high sensitivity and excellent selectivity of the method, and suggest a new approach useful for the identification and determination of phenylamide pesticides. (Baker-FRC)
W81-06222

THE DETERMINATION OF DISSOLVED TOTAL NUCLEIC ACIDS IN NATURAL WATERS INCLUDING SEA WATER,

Liverpool Univ. (England). Dept. of Oceanography.
E. Hicks, and J. P. Riley.
Analytica Chimica Acta, Vol 116, No 1, p 137-144, April, 1980. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Nucleic acids, *Water analysis, Lakes, Freshwater, Chemical analysis, Seawater.

The determination of natural levels of nucleic acids in lake and sea waters is described. Immediately after collection, the samples are filtered. To begin the analysis, the pH is adjusted to 6.8. The sample is then passed through a 1 x 5 cm column of hydroxyapatite at a flow rate of about 3 ml/minute. The percolate and washings are discarded. The column is immersed in a water bath and, after reaching thermal equilibrium at 60C, the nucleic acids are eluted by passing through 20 ml of 0.5 M phosphate buffer at a flow rate of 0.3 ml/min. The eluate is collected, and 20 ml of iron(III)-orcinol mixed reagent is added. The flask is covered and heated in a boiling water bath for 45 min. After cooling, the contents are transferred to a 50-ml calibrated flask and diluted to volume with distilled water. The absorbance of the resulting solution is measured at 670 nm in a 4-cm cuvette against distilled water. The procedure showed coefficients of variation of 2.9% and 2.4% with lake and sea waters containing nucleic acids at the 47 and 79 microgram/liter levels, respectively. No interference of significance was noted by fulvic and humic acids, amino acids, carbohydrates and fatty acids at levels of 10 mg/l. (Baker-FRC)
W81-06223

APPLICATION OF THE CAP-PAIR EFFECT IN REDUCING THE INHIBITION OF ELECTRODE PROCESSES. THE DETERMINATION OF ZINC IN THE PRESENCE OF TWEEN-80,

K. Sykut, G. Dalmata, B. Nowicka, and J. Saba.
Analytica Chimica Acta, Vol 118, No 2, p 369-372, August, 1980. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Zinc, *Water analysis, Chemical analysis, Polarography, Electrodes, Surfactants, Emulsifiers, Detergents, *Polarographic analysis.

Inhibition of electrode processes at the dropping mercury electrode severely limits direct application of polarographic methods for metals in the presence of surface-active substances, for example in surface waters, groundwater, and sewage. A procedure is presented for reducing the inhibition of electrode processes caused by surface-active substances during polarographic determinations of zinc. An organic substance which meets the requirements of the 'cap-pair' effect is added to the sample before polarography. This method is described for the determination of zinc in the presence of Tween-80. In the square-wave polarography of zinc at the 10 micromolar level, addition of 10 grams of thiourea per liter eliminated or greatly reduced the inhibitory action of Tween-80, thus allowing precise determinations. Without the addition of thiourea, as the Tween concentration increased, the height of the zinc peak decreased linearly, the peak being completely repressed by 0.0028% Tween at zinc concentrations of 50 micromolar. The introduction of thiourea diminished this inhibition of the zinc peak in a concentration dependent manner. This method should also be applicable for the determination of other depolarizers in the presence of various surface-active substances, given an appropriate organic substance which fulfills the conditions determined by the 'cap-pair' principle. (Baker-FRC)
W81-06224

EXTRACTION AND CONCENTRATION OF PHENOLIC COMPOUNDS FROM WATER AND SEDIMENT,

Geological Survey, Lakewood, CO.
M. C. Goldberg, and E. R. Weiner.
Analytica Chimica Acta, Vol 115, p 373-378, March, 1980. 1 Tab, 27 Ref.

Descriptors: *Phenolic pesticides, *Chemical analysis, Water analysis, Sediments, Phenols, Industrial wastes, Gas chromatography.

Continuous liquid-liquid extractors are used to concentrate phenols at the microgram per liter level from water into dichloromethane. The extraction step is followed by Kuderna-Danish evaporative concentration and gas chromatography. The procedure requires 5 hr for 18 liters of sample water. Overall concentration factors of around 1000 are obtained, and the overall concentration efficiencies vary from 23.1 to 87.1%. Concentration efficiencies determined by a batch method suitable for sediments range from 18.9 to 73.8%. Individual phenolic compounds were processed in a system consisting of four continuous liquid-liquid extractors arranged in series and Kuderna-Danish evaporative concentrators. The batch sampling Soxhlet extractor system is well suited to extracting phenolic compounds from stream sediments. The various phenolic compounds studied included phenol; o-, m-, and p-chlorophenol; 2,4-dichlorophenol; 2,4,5-trichlorophenol; 1- and 2-naphthol; o-methoxyphenol; o-aminophenol; o-nitrophenol; o- and m-cresol; and 2,6-dimethylphenol. It was noted that the overall extraction and concentration efficiencies of the liquid-liquid extractor system were of more significance for monitoring trace phenolic levels in water than were the overall concentration factors, which depend strongly on the arbitrary choices of starting volume of sample and final volume of concentrate. (Baker-FRC)
W81-06225

A BABINGTON-TYPE NEBULIZER FOR USE IN THE ANALYSIS OF NATURAL WATER SAMPLES BY INDUCTIVELY COUPLED PLASMA SPECTROMETRY,

Geological Survey, Lakewood, CO.
J. R. Garbino, and H. E. Taylor.
Applied Spectroscopy, Vol 34, No 5, p 584-590, September/October, 1980. 9 Fig, 6 Tab, 22 Ref.

Descriptors: *Emission spectroscopy, *Chemical analysis, *Water analysis, Water quality, Monitoring, Particulate matter, Laboratory equipment.

A Babington-type pneumatic nebulizer was developed and evaluated for use in the inductively coupled plasma emission spectrophotometric analysis of natural water samples. Construction of the apparatus is detailed. The operational characteristics of the apparatus offer the analyst a nebulization system that demonstrates equivalent or superior sensitivity and detection limits over the conventional crossbow nebulizer. Also, there are no troublesome maintenance problems such as those

caused by particulate clogging of the crossbow type. A factorial experimental design approach was used to evaluate and optimize the nebulizer's operation characteristics. Impinger head position and the sample delivery rate each had a small but measurable effect on the analytical sensitivity for each of the analyte elements. Each analyte element had a unique set of optimal operating conditions. Memory effects were investigated, and all constituents except lead and silica were rapidly removed from the system with blank nebulization. (Small-FRC)
W81-06232

DETERMINATION OF MIXTURES OF BENZO(A)PYRENE, 2,6-DIMETHYLNAPHTHALENE AND THEIR METABOLITES BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH FLUORESCENCE DETECTION,
National Marine Fisheries Service, Seattle, WA. Environmental Conservation Div.
M. M. Krahn, J. V. Schnell, M. Y. Uyeda, and W. D. MacLeod, Jr.
Analytical Biochemistry, Vol 113, No 1, p 27-33, May 1, 1981. 2 Fig, 3 Tab, 27 Ref.

Descriptors: *Pollutant identification, *Chromatography, Hydrocarbons, Benzo(a)pyrenes, Naphthalenes, Fluorescence.

Benzo(a)pyrene (BaP) and 2,6-dimethylnaphthalene (DMN) were incubated with liver microsomes of coho salmon to demonstrate that two polynuclear aromatic hydrocarbons (PAHs) could be determined by high-performance liquid chromatography (HPLC) and ultraviolet fluorescence (UVP) in the presence of each other. The HPLC/UVF quantitation described enabled determination of BaP, DMN, and their respective metabolites separately or in mixtures of the two. In addition, methods for stopping the incubations and preparing the samples for HPLC analysis were established. Individual metabolites were separated by HPLC and quantitated at fluorescence excitation and emission wavelengths characteristic of the corresponding parent hydrocarbon. The method proved rapid, sensitive and selective for determination of metabolic products in a two-substrate system. The technique has the potential for use in multisubstrate systems and in field studies. Several substrates having different excitation-emission wavelength settings could be determined by UVF in the presence of each other without interference, leading to the assay of xenobiotic metabolites in organisms exposed via their natural environments. (Baker-FRC)
W81-06233

SEASONAL VARIATION OF TRACE-METALS IN THE MUSSEL MYTILUS CALIFORNIANUS,
Rhode Island Univ., Kingston. Dept. of Geography and Marine Affairs.
T. R. Ouellette.
Environmental Conservation, Vol 8, No 1, p 53-58, Spring, 1981. 9 Fig, 1 Tab, 36 Ref.

Descriptors: *Mussels, *Mytilus, *Trace metals, Seasonal variation, Climatic data, Hydrography, Aluminum, Manganese, Lead, Cadmium, Copper, Iron, California.

Biological and environmental mechanisms governing the seasonal variation of trace metals in mussels were investigated in Mytilus californianus collected at Soberanes Point, Monterey County, California. The depuration of trace metals from the digestive systems of the mussels was monitored. Seasonal variations were observed, with twofold to threefold changes in concentration occurring during the year-long sampling period. The variations were directly related to annually-cyclic climatic and/or hydrographic conditions. The accumulation of iron, aluminum, and magnanese, and to some extent lead, was directly related to the input to inshore waters of terrigenous material by storm-generated runoff and bottom resuspension during the winter months. Accumulation of copper was related to elevated concentrations of organic copper-complexing compounds in the water column during the winter and during upwelling. Increased cadmium accumulation during the spring was proportional to increased surface nutrient concentrations. (Small-FRC)
W81-06246

ATOMIC EMISSION SPECTROMETRIC DETERMINATION OF MERCURY IN NATURAL WATERS AT THE PART-PER-TRILLION LEVEL,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
J. L. Bricker.
Analytical Chemistry, Vol 52, No 3, p 492-496, March, 1980. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Mercury, *Water analysis, *Natural waters, Rivers, Effluents, Wastewater analysis, Atomic emission spectrometry.

A field method for the preconcentration of traces of mercury from natural waters onto gold is presented. Mercury(II) ions, methyl mercury compounds, and phenylmercury compounds are reduced in the field to metallic mercury by reaction with sodium borohydride and scrubbed from solution onto a gold sampling tube. Mercury is determined using a helium-dc plasma emission spectrometer system, set on the 2537-Angstrom mercury line. The lower detection limit is 0.5 ppt for a 20-ml sample, with a relative standard deviation of less than two percent. Samples down to one ppt total mercury have been analyzed. Mercury was determined in natural water samples collected from the Fort Pierce area. The necessity of sample filtration was clearly demonstrated in these samples. The filtered sample was not only 40% lower in mercury, but was more consistent that the unfiltered Link Port sample. Total mercury of aqueous samples cannot be compared to the total mercury content of aqueous plus suspended matter. A 68 and 83% mercury loss from samples stored in Teflon for 24 hr was noted in the Fort Pierce Inlet and Harbor Branch Foundation sewage samples, respectively. Losses were also noted from glass containers, but glass was far superior to Teflon for storage of both distilled and river water samples. (Baker-FRC)
W81-06249

SIMULTANEOUS DETERMINATION OF FIVE TRACE METALS IN SEAWATER BY INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROMETRY WITH ULTRASONIC NEBULIZATION,
National Research Council of Canada, Ottawa (Ontario). Div. of Chemistry.
S. S. Berman, J. W. McLaren, and S. N. Willie.
Analytical Chemistry, Vol 52, No 3, p 488-492, March, 1980. 2 Fig, 6 Tab, 25 Ref.

Descriptors: *Trace metals, *Water analysis, Metals, Copper, Lead, Chromium, Cobalt, Iron, Manganese, Cadmium, Nickel, Zinc, *Seawater, Estuarine environment, Atomic emission spectrometry, Ultrasonics, Ultrasonic nebulization.

Nine trace metals, iron, manganese, copper, zinc, nickel, chromium, cobalt, cadmium, and lead, were determined in seawater by a combination of ion-exchange preconcentration and inductively coupled plasma-atomic emission spectrometry (ICP-AES) using ultrasonic nebulization with aerosol desolvation. Results are presented for the first five of the above metals in a relatively unpolluted coastal seawater sample. The performance of the ultrasonic nebulizer is assessed with reference to that of a cross-flow pneumatic nebulizer. Ultrasonic nebulization with aerosol desolvation is used to introduce the metal concentrates to the plasma. Accuracy for the first five metals is within 0.1 microgram/liter at the 1 microgram/liter level, and standard deviations range from 0.1 to 0.3 microgram/liter. Chromium, cadmium, cobalt, and lead levels in the concentrate from the samples analyzed remained at levels below which reliable results could be attained. To include these metals in the analysis, improvements will be needed in the preconcentration procedure, or still lower ICP detection limits will be needed, especially if offshore seawater samples are also to be analyzed. Clearly the performance of the ultrasonic nebulizer and desolvation apparatus has not been optimized. (Baker-FRC)
W81-06250

DETERMINATION OF TRACE AMOUNTS OF LEAD IN WATER BY METASTABLE TRANSFER EMISSION SPECTROMETRY,
The Aerospace Corp., El Segundo, CA. Aerophysics Lab.
J. E. Melzer, J. L. Jordan, and D. G. Sutton.
Analytical Chemistry, Vol 52, No 2, p 348-389, February, 1980. 2 Fig, 5 Ref.

Descriptors: *Lead, *Trace metals, Metals, Water analysis, Chemical analysis, *Emission spectroscopy, Spectroscopy.

Metastable transfer emission spectrometry (MTES) has been applied to the detection of trace metals in water. The MTES technique depends on the activation of fluorescence from the constituents of the sample by contact with active nitrogen in the gas phase. Thus, the liquid samples must be vaporized in a manner compatible with the detection and measurement of the resulting fluorescence. This is accomplished by staged heating of a tantalum receptacle containing the liquid sample. When lead vapor is mixed with active nitrogen, a simple emission spectrum dominated by a few neutral lead lines results. Lead in aqueous solution has been detected by monitoring the lines at 283.3 and 405.8 nm. Individual samples consisting of 20 microliter aliquots of standard Pb solution diluted in 0.3 N HN03 were analyzed. Measurement of an occurrence of environmental pollution was undertaken by collecting five leaves from a eucalyptus tree adjacent to the San Diego Freeway in California and washing the leaves with HN03. By the method described above, the concentration of lead in the washing solution was determined to be 22 ppm. Thus the average 1 gram leaf carries 23 micrograms of lead. This was particularly interesting, as there had been a rainstorm only three days prior to collection of the leaves. (Baker-FRC)
W81-06251

SUB-PART-PER-BILLION DETERMINATION OF TOTAL DISSOLVED SELENIUM AND SELENITE IN ENVIRONMENTAL WATERS BY X-RAY FLUORESCENCE SPECTROMETRY,
Antwerp Univ., Wilrijk (Belgium). Dept. of Chemistry.
H. J. Robberecht, and R. E. Van Grieken.
Analytical Chemistry, Vol 52, No 3, p 449-453, March, 1980. 8 Tab, 35 Ref.

Descriptors: *Selenium, *Water analysis, Chemical analysis, Rivers, Drinking water, Rain, Natural waters, Estuarine environment, Fluorescence, *X-ray fluorescence, Spectrometers.

The tetravalent and hexavalent selenium content of different environmental water types was determined after preconcentration on activated carbon by simple energy-dispersive X-ray fluorescence (ED-RF). Immediately after sampling, pretreatment with HC1, HN03, and double distilled water, the natural water samples are filtered through a Nucleopore membrane to collect suspended matter and acidified with HC1. Samples can then be stored for several weeks. The preconcentration procedure for the total dissolved selenium and the specific preconcentration procedure for selenite are applied to different aliquots of the sample. The filters loaded with the activated carbon to which the resulting elemental selenium is adsorbed are measured in the ED-XRF-unit for 3000 sec. The spectrum analysis makes use of a nonlinear least-squares fitting program. The area under the Se K alpha peak is computed. If the thickness of the carbon loading on the filter is not homogeneous, there is a method for evaluating effective sample thickness in the X-ray beam so that the measured selenium content can be corrected by the ratio of what was actually added to the apparently analyzed activated carbon quantity. The filter containing the particulate matter from the natural water sample can be analyzed separately for selenium, if desired. The method has been used on various samples from rivers, estuaries and the sea, rain and

snow, drinking water supplies, swimming pools, and cold and geothermal springs. (Baker-FRC)
W81-06252

IMPROVED METHOD FOR THE USE OF PROPORTIONING INJECTORS TO CONDITION LARGE VOLUMES OF WATER FOR VIROLOGICAL ANALYSIS,
Quebec Univ., Montreal.
P. Payment, and M. Trudel.
Canadian Journal of Microbiology, Vol 27, No 4, p 455-457, April, 1981. 2 Fig, 15 Ref.

Descriptors: *Viruses, *Water sampling, *Bypass channels, Pollutant identification, Sample preparation, *Water analysis, Turbidity, Flowmeters, Hydrogen ion concentration.

A simple apparatus designed to add chemicals to large volumes of water being sampled for viral analysis by the Wallis-Melnick method (1972) has been described. When this device is used on large volumes of turbid water, however, clogging of filters will cause the filters to stop injecting. To correct this problem, injectors may be placed at the inlet of a pump, or a bypass may be used. The bypass system made from high temperature plastic fittings and stainless steel quick-connects permits the use of low flow rate injecting proportioners which are less sensitive to back pressure buildup. The system may be used during sampling to condition water at flow rates of 5-15 liters/minute. Since the system is based only on final pH value, more accurate volume monitoring may be achieved when a flowmeter is inserted into the system. (Geiger-FRC)
W81-06274

ISOLATION OF VIRUSES FROM DRINKING WATER AT THE PONT-VIAU WATER TREATMENT PLANT,
Quebec Univ., Montreal.
P. Payment.
Canadian Journal of Microbiology, Vol 27, No 4, p 417-420, April, 1981. 2 Tab, 19 Ref.

Descriptors: *Pollutant identification, *Drinking water, *Viruses, *Raw water, Potable water, Water treatment, Separation techniques, Water pollution, Coliforms, Pathogens, Isolation, Water pollution treatment.

An Environmental Protection Agency method for the isolation of viruses from drinking water was used on raw and treated volumes of water taken from the Pont-Viau water treatment plant in Canada. Results showed that the real inactivation magnitude of the procedure is not as high as predicted. Viruses were isolated from every water sample, but few plaque-forming isolates were found. Cytopathogenic viruses were found as frequently in drinking water as in untreated, sewage-contaminated river water, usually at levels of 1-10 cytopathogenic units/liter. Treatment by prechlorination, flocculation, filtration, ozonation and postchlorination had little effect on virus removal. No coliforms were detected in treated samples, while Poliovirus type 1 was a frequent isolate. The efficacy of the water treatment methods used is questioned in view of the present findings. (Geiger-FRC)
W81-06275

BACKGROUND HYDROCARBON RESIDUES IN FISHES FROM THE GREAT LAKES AND EASTERN MONTANA,
Johnson (S.C.) and Son, Inc., Racine, WI.
K. J. Welch, D. W. Kuehl, E. N. Leonard, G. D. Veith, and N. D. Schoenthal.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 6, p 724-728, June, 1981. 1 Fig, 2 Tab, 7 Ref.

Descriptors: *Fish, *Hydrocarbons, Watersheds, Chemical analysis, Tetradecane, Pentadecane, Hexadecane, Heptadecane, Octadecane, Nonadecane, *Montana, Rivers, Great Lakes.

Quantitative data are presented for background levels of hydrocarbons in fishes from selected eastern Montana watersheds. Watersheds were chosen which had coal extraction and conversion activities and compared with watersheds where these activities do not occur. Total n-hydrocarbon residues in the Montana fishes ranged from 1.3 to 160 micrograms/gram. In most samples the odd-numbered n-hydrocarbons accounted for over 80% of the hydrocarbon residue. In 16 samples n-hepatadecane was the predominant hydrocarbon. In two of the samples n-pentadecane levels were greater than n-heptadecane. A hydrocarbon of molecular weight 288 was observed in some samples, and assigned the molecular formula of C21H36. Various n-hydrocarbons detected included tetradecane, pentadecane, hexadecane, heptadecane, octadecane, and nonadecane. Smaller quantities of the corresponding unsaturated hydrocarbons were also found including pentadecene, heptadecene, heptadecadiene, octadecene, nonadecene, nonadecadiene, and dodecadiene. All these samples were collected in watersheds used predominantly for grazing. No apparent relationships were found between the hydrocarbon residues and discernible land-uses and/or industrial discharges which would lead to hydrocarbon pollution of the watershed. The hydrocarbons found are probably biogenic in origin. (Baker-FRC)
W81-06277

PHTHALIC ACID ESTERS, TOTAL DDTS, AND POLYCHLORINATED BIPHENYLS IN MARINE SAMPLES FROM GALVESTON BAY, TEXAS,
Texas A and M Univ., College Station. Dept. of Chemistry.
H. E. Murray, L. E. Ray, and C. S. Giam.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 6, p 769-774, June, 1981. 1 Fig, 2 Tab, 10 Ref.

Descriptors: *Sediments, *Sea water, *Organic compounds, DDT, Polychlorinated biphenyls, Phthalic acid esters, Galveston Bay, Texas, Bays, Estuarine environment, Estuaries, Industrial wastes, Oil industry, Municipal wastes, Outfalls, Recreational facilities.

The Galveston Bay system was studied from Morgan's Point, where the Houston Ship Channel joins the Bay, to Bolivar Peninsula and Galveston Island. This area includes Trinity, East and West Bays. Sample collection sites were selected near suspected point and nonpoint sources of pollution. Site 1 represents a point source from the Galveston sewage outfall. Sites 2 and 3 are point sources from the Houston Ship Channel and Texas City Channel. Site 4 is a nonpoint source. Sites 6, 7, and 8 are point sources polluted from oil platforms. Site 5 was believed to be relatively unpolluted. Total DDTs ranged from less than 0.1 to 3.5 ng per liter, with an average concentration of 0.38 ng/liter. PCB concentrations ranged from less than 0.01 to 70 ng/liter, with an average of 3.1 ng/liter. DEHP concentrations ranged from less than 2 to 12,000 ng/liter, with an overall average of 600 ng/liter. Total DDT values reported for sediments from the Mississippi Delta and along the Gulf Coast were substantially higher than those in the Galveston Bay area. PCB concentrations along the Mississippi Delta ranged from 0.2 to 35 ng/g, while along the Gulf Coast concentrations in sediments were 0.2 to 6 ng/gram with an average of 2.0 ng/gram. DEHP concentrations along the Mississippi Delta sediments ranged from less than 0.1 to 250 ng/g, with an average of 69 ng/g. Concentrations for sediments along the Gulf Coast ranged from 3.4 to 14 ng/g with an average of 6.6 ng/g. This study revealed that the relative concentrations were greatest for DEHP and lowest for DDTs in both water and sediments. (Baker-FRC)
W81-06278

COMPREHENSIVE APPROACH TO PREPARATIVE ISOLATION AND FRACTIONATION OF DISSOLVED ORGANIC CARBON FROM NATURAL WATERS AND WASTEWATERS,
Geological Survey, Denver, CO.
J. A. Leenheer.
Environmental Science and Technology, Vol 15, No 5, p 578-587, May, 1981. 6 Fig, 5 Tab, 26 Ref.

Descriptors: *Ion exchange resins, *Water analysis, *Organic compounds, Chemical analysis, Natural waters, Dissolved organic matter, Adsorbents, Waste water analysis, Pollutant identification.

A multistep scheme for separating complex mixtures of organic solutes from water and inorganic salts and fractionating them into six classes used a series of resin adsorbents. This system, known as preparative dissolved organic carbon fractionation, recovered 95% of the dissolved organic carbon from resin adsorbents using oil shale retort wastewater and 115% using a river water. Further evaporation and desalting of the resulting organic fractions recovered 81% of dissolved organic carbon. The six classes of compounds were as follows: hydrophobic bases (proteinaceous substances, amides, amines), hydrophobic acids (fulvic acids), hydrophobic neutrals (hydrocarbons, carbonyl groups), hydrophilic bases (amphoteric proteinaceous substances), hydrophilic acids (hydroxyl and carboxyl groups), and hydrophilic neutrals (polysaccharides). This system may be used for qualitative and quantitative analysis of water and to produce fractions for chemical and biological testing. (Cassar-FRC)
W81-06281

ANALYTICAL MONITORING IN GROUNDWATER PROTECTION FROM OIL POLLUTION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
S. G. Mel'kanovitskaya, and V. I. Prosenkov.
Water Resources (English Translation), Vol 7, No 3, p 237-247, May-June, 1980. 6 Fig, 1 Tab, 7 Ref. Translated from Vodnye Resursy, No 3, p 93-105, May-June, 1980.

Descriptors: *Petroleum products, *Oil pollution, *Water analysis, *Pollutant identification, Gas chromatography, Aquifers, Hydrocarbons, Organic compounds, Fuel, Gasoline, Path of pollutants.

Three types of methods for analyzing traces of pollution from petroleum and its products in natural waters are: nonspecific, for quantitative determinations (gravimetric, turbidimetric); group specific (optical); and highly specific (gas chromatography and gas chromatography/mass spectrometry). Two gas chromatographic methods capable of detecting crude oils and petroleum products at the level of the maximum allowable concentration (0.3-0.01 mg per liter) have been developed. Dissolved petroleum products and gasoline are extracted with nitrobenzene, chromatographed, and detected by flame ionization. Heavier products are extracted with hexane, chromatographed, and detected by differential flame ionization. The methods were applied to groundwater aquifers near Moscow. Hydrocarbons from nearby industrial and fuel leaks had been organoleptically detected in wells. Results not only indicated the composition of the oily materials but made it possible to identify sources of pollution. (Cassar-FRC)
W81-06302

STATE AND PROBLEM OF WASTEWATER ANALYSIS,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh, Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
Yu. M. Dedkov.
Water Resources (English Translation), Vol 7, No 3, p 265-272, May-June, 1980. 3 Tab, 38 Ref. Translated from Vodnye Resursy, No 3, p 149-159, May-June, 1980.

Descriptors: *Water analysis, *Wastewater analysis, Chemical analysis, Pollutant identification, Organic compounds, Chromatography, Spectroscopy, Quantitative analysis, Water quality control, Monitoring, Sampling, *USSR.

Problems of wastewater analysis are discussed. In the USSR, water quality assessment is based on the maximum allowable concentration system, which is only concerned with the quality of water entering surface bodies, not the suitability of water for reuse. The system also concerns pollutants in their

pure form only and ignores their additive properties. Only 569 indices are on the monitoring list, whereas the EPA suggests determining 1300 organic compounds in water. Water analysis systems in present use rely heavily on organoleptic properties. Only 30% of the analytical stations have adequate instrumentation. Thirteen of 39 existing state standards on water quality assessment methods were developed before 1951. Many methods are insufficient for the very complex mixtures, such as impurities in an industrial product, which are analyzed. The author emphasizes the importance of knowing what compounds might be present in a given wastewater before choosing methods of analysis. An integrated water quality index system would consider each type of water use and list appropriate tests. Analytical methods need to be refined. In particular, the extraction and concentration methods which destroy or alter the character of trace contaminants must be replaced with less destructive procedures--sorption on neutral sorbents, freezing, extraction chromatography, and coprecipitation. Use of chromatography, spectroscopy, and computerization in water analysis should be further explored. Other problems requiring immediate solution are collection and preservation of samples, optimum sampling frequency, and automation. (Cassar-FRC)
W81-06303

INTERCALIBRATION FOR TRACE METALS IN SEAWATER,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
J. M. Bewers, J. Dalziel, P. A. Yeats, and J. L. Barron.
Marine Chemistry, Vol 10, No 3, p 173-193, April, 1981. 8 Tab, 16 Ref.

Descriptors: *Trace metals, *Calibrations, *Seawater, Water analysis, *Pollutant identification, Heavy metals, Metals, Chemical analysis, Sample preservation.

The Fourth Round International Intercalibration for Trace Metals in Seawater concentrated on analytical precision and spike recoveries in metal analysis of seawater. Considerable improvements in precision were evident since the previous intercalibration. Results for frozen replicate samples, dummy samples, and spike recoveries were generally lower than results for acidified samples. The differences between atomic absorption and anodic stripping analysis were small but significant for Cd and Pb and insignificant for Cu and Zn. Metals included in the intercalibration were Cd, Su, Mn, Fe, Pb, Zn and Ni. Contamination of samples with Zn and Pb was a problem, and sample preparation methods must be reexamined before low level calibration can be effectively conducted. (Cassar-FRC)
W81-06314

ORGANOCHLORINE RESIDUES IN FISH: NATIONAL PESTICIDE MONITORING PROGRAM, 1970-74,
Columbia National Fisheries Research Lab., MO.
C. J. Schmitt, J. L. Ludke, and D. F. Walsh.
Pesticides Monitoring Journal, Vol 14, No 4, p 136-206, March, 1981. 4 Fig, 7 Tab, 36 Ref.

Descriptors: *Pesticide residues, *Fish, *Aquatic animals, Organic pesticides, Pesticides, DDT, Polychlorinated biphenyls, Dieldrin, Toxaphene, Water quality, Chemical analysis.

Organochlorine residues were analyzed in fish samples collected from about 100 sites during 1970 through 1974 as part of the National Pesticide Monitoring Program. This United States Fish and Wildlife Service study found that mean residues of DDT and its metabolites had declined nationally but were still widespread. Levels were still high in areas where DDT had been used heavily. Trends in PCB residues were less obvious, with the highest PCB residues being found in the industrialized areas of the Northwest and Midwest. Traces of PCB were present at most of the 100 stations. Dieldrin residues were widespread, and were highest in Hawaii and areas of the Midwest where aldrin was used extensively. An increase was found in the occurrence of toxaphene. It was formerly found only in fish from streams draining cotton-farming regions, but it was found in other areas in the present study. According to the National Academy of Sciences, Water Quality Criteria, organochlorine residues may be a hazard to fish and wildlife at 71% of the stations sampled in 1970 and 66% sampled in 1974. (Small-FRC)
W81-06316

PROCESSING WASTEWATER FROM TWO MECHANIZED SALMON CANNERIES,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5B.
W81-06325

REMOVAL OF INORGANIC 14C FROM WATER SAMPLES IN LIQUID SCINTILLATION MIXTURES,
Wayne State Univ., Detroit, MI. Dept. of Biology.
G. J. Filbin, R. A. Hough, and G. W. Saunders.
Archiv fur Hydrobiologie, Vol 88, No 4, p 518-522, June, 1980. 1 Tab, 8 Ref.

Descriptors: *Phytoplankton, *Water quality control, *Carbon dioxide, Inorganic compounds, Carbon, Gases, Photosynthesis, Algae, Aquatic plants, Radioactive tracers, Productivity, Chemical analysis.

A method for removing C-14 labeled carbon dioxide from water samples in liquid scintillation solubilizer-fluor mixtures, usable in studies of photosynthesis by algae and aquatic plants, is reported. The process found to be most effective consists of acidification, incubation under an atmosphere of pure carbon dioxide at 4 C for 12 hr and nitrogen at 70 C for 6 hr, and degassing by vacuum for 1 hr. Even though the decontamination was not absolute, the residual was uniformly small when compared with the starting amount, ranging from 0.7 to 1.5% in polyethylene vials and 0.01-0.08% in glass vials. In using this method on large numbers of samples from phytoplankton photosynthesis experiments it was found that samples generally of aberrantly high radioactivity are brought to within the range of other samples in a given series with minimal reduction in activity of the normal samples, even though the latter must be tested and accounted for when significant loss of organic label occurs. The method appears satisfactory for recovery of inadequately treated samples containing total fixed particulate and organic carbon. The method is not satisfactory for quantification of small amounts of dissolved organic carbon alone. (Baker-FRC)
W81-06347

INVESTIGATIONS ON DISSOLVED COPPER-ORGANIC SUBSTANCES IN BALTIC WATERS,
Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde.
K. Kremling, A. Wenck, and C. Osterroht.
Marine Chemistry, Vol 10, No 3, p 209-219, April, 1981. 7 Fig, 1 Tab, 18 Ref.

Descriptors: *Copper, *Chelation, *Water analysis, *Seawater, Pollutant identification, *Baltic Sea, Dissolved organic matter, Organic matter.

A technique for isolation and separation of dissolved copper-organic complexes from large amounts of seawater was developed and used in a survey in the Bothnian and Gotland Seas of the Baltic. Experiments were conducted at pH two to eight to obtain a higher amount of dissolved organic matter from the sample and to study the copper complexing capacity at different pH. The apparatus pumps seawater through Amberlite XAD-2 resin or silanized controlled pore glass to trap the organic substances. After elution, samples are analyzed by atomic absorption spectrophotometry at 345 nm. In both areas of the Baltic, organic copper fractions were about 5% of the total 1.0 micrograms per liter copper. (Cassar-FRC)
W81-06351

AN EXPERIMENTAL STUDY ON IRON ACCUMULATION IN THE CLAM MACTRA LILACEA,
Cape Town Univ. (South Africa). Dept. of Zoology.
L. Beckley.
Marine Pollution Bulletin, Vol 12, No 4, p 138-139, April, 1981. 2 Fig, 7 Ref.

Descriptors: *Bioindicators, *Clams, *Iron, Bays, Water pollution sources, *Pollutant identification, Mollusks, Atomic absorption spectroscopy.

Mactra lilacea was investigated as a possible indicator for iron ore pollution in the Saldanha Bay on the west coast of South Africa. A large iron export terminal was recently built in the area, and the effect of its operation on the abundant and diverse marine biota of the area was investigated. Specimens of Mactra lilacea were collected in Langebaan Lagoon, and some were exposed in aquaria to sieved iron particles at a particle load of 1 kg/cu m. Atomic absorption spectrophotometry was used to determine iron content after drying whole animals and washing them in nitric acid. After exposure to seawater with an iron ore particle load of 1 kg/cu m for 24 hr, the iron concentration in the clams increased to 112.9 micrograms/g from a control value of 43.7 micrograms/g. After 48 hr, the concentration increased to 120.8 micrograms/g. After two weeks the iron concentration had decreased to 58.7 micrograms/g. Thus, if extensive ore spillage occurred in Saldanha Bay and tidal currents carried the suspended iron into Langebaan Lagoon, Mactra would serve as immediate indicators. (Small-FRC)
W81-06355

CHARACTERIZATION OF BLEACH PLANT EFFLUENTS,
Idaho Univ., Moscow.
L. L. Edwards, J. D. Rushton, F. D. Gunseor, and R. D. Abbott.
Tappi, Vol 63, No 3, p 69-72, March, 1980. 6 Tab, 8 Ref.

Descriptors: *Pulp and paper industry, *Effluents, *Biological oxygen demand, Paper industry, Industrial wastes, Prediction, *Pollutant identification, Oxygen demand.

The benefits and problems associated with bleach plant closures were studied in the laboratory and in the plant. Daily samples were taken from five locations in a bleached Kraft pulp and paperboard mill and analyzed for BOD, COD, total organic carbon, total dissolved solids, total organic dissolved solids, total inorganic dissolved solids, chloride, and sodium. Statistical analysis produced a method for predicting incremental changes in BOD by multiplying COD, total organic carbon, or total organic dissolved solids by designated factors. These factors are different for each parameter and for each station--chlorine dioxide mat liquor, brown stock decker mat liquor, E-stage effluent, C-stage mat liquor, and C-stage effluent. (Cassar-FRC)
W81-06373

HEAVY METAL CONTENT OF CALLIANASSA SPP. IN WESTERN PORT,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
M. Ahsanullah, D. S. Negilski, and F. Tawfik.
Australian Journal of Marine and Freshwater Research, Vol 31, No 6, p 847-850, December, 1980. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Heavy metals, *Estuaries, Coasts, Western Port, *Australia, Zinc, Copper, Cadmium, Lead, Callianassa spp., Benthos, Aquatic life.

This work presents the results of a bay-wide survey of zinc, copper, cadmium and lead content of Callinassa spp. in Western Port. These data could serve as a baseline with which future observations of metal content in these and other species may be compared. In general metal concentrations were similar for all species, although for zinc, cadmium, and lead the range of concentrations found was greatest in C. australiensis. For copper

the greatest range was found in C. arenosa. Mean zinc concentrations tended to be highest for C. australiensis, with the highest total concentration recorded being 225 micrograms/g. The highest mean value of cadmium was in C. limosa, but the highest total concentration of 0.8 micrograms/g was found in C. australiensis. The highest mean value of copper and its highest total concentration, 334 micrograms/g, were recorded in C. arenosa. The highest average and total concentrations of lead, 4.9 micrograms/g, were found in C. australiensis. These findings suggest that Western Port may be considered as relatively uncontaminated by heavy metals, in so far as this is indicated by metal content of the biota. (Baker-FRC)
W81-06389

CHEMICAL STUDIES OF FOUR SWAMPS ON THE NOTHERN TABLELANDS OF NEW SOUTH WALES,
University of New England, Armidale (Australia). School of Natural Resources.
S. V. Briggs.
Australian Journal of Marine and Freshwater Research, Vol 31, No 6, p 729-736, December, 1980. 2 Tab, 22 Ref.

Descriptors: *Swamps, *Chemical composition, *Australia, Calcium, Magnesium, Potassium, Nitrogen, Phosphates, Phosphorus, Nitrates, Wetlands, Bogs, Marshes, Urban areas, Urban runoff.

This study was designed to provide data on chemical conditions in four wetlands on the northern tablelands of New South Wales and also to test the hypothesis that waterbird density is related to water chemistry. Concentrations of calcium, magnesium, sodium, potassium, nitrate-nitrogen, phosphate-phosphorus, conductivity, total alkalinity, pH and water level were measured monthly in four swamps on the northern tablelands of New South Wales The order, in decreasing levels of concentration, for cationic dominance was sodium, magnesium, calcium, and potassium. One wetland had markedly higher ionic concentrations than the rest, possibly due to an urban area in its catchment. Rainfall, water level and the effects of season on nutrient uptake and release by aquatic vegetation accounted for much of the temporal variation in ionic concentrations and loadings in the wetlands. There was no obvious correlation between water chemistry of the wetlands and waterbird densities. (Baker-FRC)
W81-06398

ALKYLMERCURY LEVELS IN MARINE SEDIMENTS IN COCKBURN SOUND, WESTERN AUSTRALIA,
Western Australia Government Chemical Labs., Perth.
D. L. Collett, G. A. Taylor, and A. Chegwidden.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 6, p 757-763, June, 1981. 2 Fig, 10 Ref.

Descriptors: *Mercury, *Marine sediments, Sediments, Marine environment, Alkylmercury, Biomethylation, Chemical analysis, *Australia, Western Australia, Outfalls, Fertilizers, Industrial wastes, Fate of pollutants.

Samples were taken from the seafloor in a predetermined grid pattern. Water depths at the sampling site ranged from 2 to 18 meters. After initial analysis of thirty-two sampling points for total mercury, a clear pattern of mercury distribution emerged for thirteen points. Saples from the other nineteen points whose relationship was less obvious were further analyzed until consistent values were obtained. Then selected points were analyzed for alkylmercury. The quantities of alkylmercury represent the mean of three or more determinations. The recovery of methylmercury chloride from spiked sediment samples, when the spike was added before freeze-drying, was 88%. The total mercury content of the spiked samples before and after freeze-drying was the same, so that the loss occurred in the distillation step and not during freeze-drying. Elemental sulfur distilled over in some of the samples. Tests with spiked samples with added sulfur (10 mg) showed that this had no effect on recoveries. Significant biomethylation has not occurred in the area sampled. (Baker-FRC)
W81-06399

IDENTIFICATION OF POLYHALOGENATED ANISOLES AND PHENOLS IN OYSTERS COLLECTED FROM TOKYO BAY,
Tokyo Metropolitan Research Lab. of Public Health (Japan).
T. Miyazaki, S. Kaneko, S. Horii, and T. Yamagishi.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 5, p 577-584, May, 1981. 2 Fig, 3 Tab, 17 Ref.

Descriptors: *Oysters, *Organic compounds, *Halogenated pesticides, *Tokyo Bay, Pesticides, Trace levels, Gas chromatography, Mass spectrometry, Pollutant identification.

Polyhalogenated anisoles and phenols in oysters from Tokyo Bay were identified by gas chromatography/mass spectrometry. The most likely source of these compounds is pentachlorophenol, found at levels of 2 ppb in the oysters, and previously used as a herbicide in the rice fields. Compounds quantified were trichloroanisole, 3 ppb; 2,4,6-tribromoanisole, 4 ppb; and pentachloroanisole, 20 ppb. Other anisole derivatives identified were bromodichloro-, chlorodibromo-, and tetrachloroanisole. Penetoles found in oyster tissue were dichloro-, trichloro-, dibromo-, chlorodibromo-, tetrachloro-, and tribromophenetole. (Cassar-FRC)
W81-06400

5B. Sources Of Pollution

PRELIMINARY HYDROGEOLOGIC INVESTIGATION OF THE MAXEY FLATS RADIOACTIVE WASTE BURIAL SITE, FLEMING COUNTY, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 5E.
W81-06074

HYDROLOGIC ASSESSMENT, EASTERN COAL PROVINCE AREA 23, ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
J. R. Harkins.
Geological Survey Open-File Report 80-683 (WRI), June, 1980. 76 p, 30 Ref, 3 Append.

Descriptors: *Hydrologic aspects, *Coal, *Surface water, *Groundwater, Water quality, Watersheds, Geohydrology, Land use, Water use, Observation wells, Water level, Flow characteristics, Erosion, Sedimentation, *Strip mines, Mine drainage, *Alabama, Eastern coal province, Black Warrior River basin, Cahabe River basin, Buttahatchee River basin, Sipsey River basin, Strip mine wastes.

The Eastern Coal Province is divided into 24 separate hydrologic reporting areas. The division is based on hydrologic factors, location, size, and mining activity. Hydrologic units (drainage basins) or parts of units are combined to form each area. Area 23 is located at the southern end of the Eastern Coal Province, in the Mobile River basin, includes the Warrior, Cahaba, and edges of the Plateau coal fields in Alabama, and covers an area of 4,716 square miles. It is underlain by the Coker and Pottsville Formations and the pre-Pennsylvanian rocks. The Pottsville Formation contains coal beds and is overlain by the Coker Formation in the western and southern parts of the area. The pre-Pennsylvanian rocks crop out in two northeast-southwest trending belts or ridges along and near the eastern boundary where folding and faulting is common. The outcrop of rocks along the western ridge forms the divide between the Warrior and the Cahaba coal fields. Hydrologic problems relating to surface mining are (1) erosion and sedimentation, (2) decline in ground-water levels, and (3) degradation of water quality. Average annual sediment yields can increase by four magnitudes in surface mined areas from 20 tons per square mile per year from areas not affected by mining to 300,000 tons per square mile per year from mined areas. Sediment yields increase drastically when vegetation is removed from the highly erosive soils and from unregulated surface mining operations. Decline in ground-water levels can occur in and near surface-mining areas when excavation extends below the static water level in the aquifer. (USGS)
W81-06076

A PROCEDURE FOR PREDICTING CONCENTRATIONS OF DISSOLVED SOLIDS AND SULFATE ION IN STREAMS DRAINING AREAS STRIP MINED FOR COAL,
Geological Survey, Lawrence, KS. Water Resources Div.
H. E. Bevans.
Geological Survey Open-File Report 80-764 (WRI), August, 1980. 17 p, 8 Fig, 2 Tab, 14 Ref.

Descriptors: *Strip mines, *Acid mine drainage, *Water pollution sources, *Water quality, Forecasting, Dissolved solids, Pyrite, Strip mine wastes, Regional analysis, Data collections, Sites, *Kansas, Cherokee County, Crawford County.

Current trends in increased coal production necessitate the development of techniques to appraise the environmental degradation resulting from strip mining. A procedure is introduced for the prediction of dissolved-solids and sulfate-ion concentrations in streams draining strip-mined areas. Concentrations are a function of the percentage of the drainage area that has been strip mined. These relationships are expressed by regression equations computed from data collected in streams draining strip-mined areas of Cherokee and Crawford Counties in southeast Kansas. High correlation coefficients indicate that the relationships may be useful in the evaluation of present or future strip-mining operations. (USGS)
W81-06077

SALTWATER INTRUSION INTO THE OLD BRIDGE AQUIFER IN THE KEYPORT-UNION BEACH AREA OF MONMOUTH COUNTY, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
F. L. Schaefer, and R. L. Walker.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price: $2.75. Geological Survey Water-Supply Paper 2184, 1981. 21 p, 10 Fig, 1 Tab, 12 Ref.

Descriptors: *Saline water intrusion, *Aquifers, *Groundwater, *Potentiometric level, Chlorides, Water pollution sources, Groundwater movement, Wells, Water quality, Water sampling, Water level, Pumping, Selective withdrawal, Hydraulic gradient, Groundwater recharge, Coastal Plains, *New Jersey, Monmouth County, Old Bridge aquifer.

Lateral saltwater intrusion is occurring in a part of the Old Bridge aquifer in Keyport and Union Beach Boroughs in Monmouth County, N.J. Prior to 1970, chloride concentration in the aquifer ranged from 5 to 20 milligrams per liter. In 1970, water samples from wells in Keyport and Union Beach began to show abnormal increases in concentration. Data show chloride as high as 110 milligrams per liter in Keyport Borough wells in 1976 and 660 milligrams per liter in Union Beach Borough wells in 1977. The wells affected were in near-coastal areas of Keyport and Union Beach. A map of the potentiometric (water level) surface for part of the Old Bridge aquifer was constructed from water-level measurements made in 31 wells in January 1977. This map shows a cone of depression centered in Hazlet Township, Monmouth County. The evidence indicates that saline ground water is moving from the submerged outcrop of the aquifer towards the center of the cone located in Hazlet Township. The rate of ground-water flow in the area of Keyport and Union Beach in 1977 was estimated to be about 400 feet per year. Total annual withdrawals from the aquifer near Keyport and Union Beach increased from 3.9 to 80 million gallons per day from 1957 to 1976. During the same period, water levels in Hazlet Township declined from 10 feet below sea level to 45 feet below sea level. (USGS)
W81-06087

EFFECTS OF COAL FLY-ASH DISPOSAL ON WATER QUALITY IN AND AROUND THE INDIANA DUNES NATIONAL LAKESHORE, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 5D.
W81-06088

THE QUALITY OF WATER DISCHARGING FROM THE NEW RIVER AND CLEAR FORK BASINS, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
R. S. Parker, and W. P. Carey.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A103576, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-37, August, 1980. 52 p, 25 Fig, 9 Tab, 13 Ref.

Descriptors: *Water quality, *Coal mines, Data collections, Geology, Suspended sediment, *Sediment discharge, Turbidity, Sulfates, Temperature, Dissolved solids, Hydrogen ion concentration, Trace metals, *Tennessee, *New River basin, Clear Fork basin, Cumberland Plateau.

Water discharging from the heavily mined New River basin is characterized by neutral pH, low dissolved solids (less than 300 milligrams per liter) and high concentrations of suspended sediment. Approximately 590,000 tons of suspended sediment were discharged from the New River basin in 1977, as compared to an estimated 20,000 tons from the relatively unmined Clear Fork basin. More than 90 percent of the suspended sediment is silt and clay. In association with these fine-grained suspended sediments are sorbed trace metals. In 1977 the New River basin discharged an estimated 17,000 tons of suspended iron while Clear Fork only discharged an estimated 600 tons. Suspended-sediment concentration was found to be highly correlated with both suspended and total trace-metal concentrations. This correlation coupled with the nearly neutral pH of water indicates that trace metals are transported primarily in the suspended phase. The most promising indicator of the presence of coal mining was found to be dissolved sulfate. All unmined basins, sampled in this study, showed dissolved-sulfate concentrations less than 20 milligrams per liter, whereas all mined basins had dissolved-sulfate concentrations in excess of 20 milligrams per liter regardless of basin size or discharge. (USGS)
W81-06091

WASTE-ASSIMILATION CAPACITY OF THE ARKANSAS RIVER IN PUEBLO COUNTY, COLORADO, AS IT RELATES TO WATER-QUALITY GUIDELINES AND STREAM CLASSIFICATION,
Geological Survey, Lakewood, CO. Water Resources Div.
D. Cain, D. Baldridge, and P. Edelmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-227340, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-82, 1980. 104 p, 38 Fig, 22 Tab, 31 Ref.

Descriptors: *Waste-assimulative capacity, *Water quality, *Water pollution control, *Model studies, Simulation analysis, Wastewater treatment, Streams, Data collections, Ammonia, Dissolved oxygen, Nutrients, Traveltime, *Colorado, Pueblo County, Arkansas River, Reaeration rate.

The waste-assimulation capacity of a 42-mile reach of the Arkansas River in Pueblo County, Colo., was evaluated using a one-dimensional steady-state water-quality model. The model is capable of accurately predicting concentrations of carbonaceous biochemical oxygen demand, total ammonia, total nitrate and dissolved oxygen; predicted concentrations of total organic nitrogen and total nitrite are less accurate. Simulation capability for nonionized ammonia was provided by defining its relationship to total ammonia. The model was used to simulate the water-quality effects of 63 combinations of wastewater treatment at the Pueblo Wastewater Treatment Plant and CF and I Steel Corporation. The mixing zone of the effluent from the Pueblo Wastewater Treatment Plant with the Arkansas River was determined to be 2.7 miles in length during the study. (USGS)
W81-06093

TIME OF TRAVEL OF SOLUTES IN SELECTED REACHES OF OHIO STREAMS, 1973 AND 1975,
Geological Survey, Columbus, OH. Water Resources Div.
A. O. Westfall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-230393, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 77-116, October, 1977. 60 p, 7 Fig, 22 Tab, 5 Ref.

Descriptors: *Streamflow, *Flow characteristics, *Dye releases, *Traveltime, Tracking techniques, Flow rates, Discharge measurement, Pollutants, Water quality, Chemical analysis, Data collections, Sampling, Streams, *Ohio.

The basic field data for time-of-travel measurements on six streams in Ohio are presented. In general, additional data on stream cross sections, tributary inflows, and chemical analyses for mainstream and tributary flows are given. Insufficient data were obtained to establish time-distance or time-discharge relationships. (USGS)
W81-06095

BACTERIOLOGICAL GROUND WATER QUALITY CHARACTERISTICS OF THE WALNUT GULCH EXPERIMENTAL WATERSHED,
Arizona Game and Fish Dept., Phoenix.
K. S. Hanks, D. E. Wallace, and H. A. Schreiber.
Science and Education Administration, Conservation Research Report Number 28, July, 1981. 15 p, 17 Fig, 3 Tab, 32 Ref.

Descriptors: *Ephemeral streams, *Watersheds, *Groundwater pollution, *Coliforms, *Bacteria, Streptococcus, Nonpoint pollution sources, Storm runoff, Land use, Rangeland, Southwestern U.S.

Transmission losses from ephemeral channels are a major ground water recharge mechanism in southwestern rangelands. Wells located near large ephemeral streams in the Walnut Gulch Experimental Watershed in Arizona were sampled to determine the influence of recharging storm runoff on ground water quality. The wells reacted in a cyclic pattern with fecal coliform to fecal streptococci ratios ranging from extremely low values prior to storm runoff (0.003) to high values (6.60) immediately after runoff events. The wells then quickly returned to the original low bacteria counts. This indicates a highly porous subsurface material which allows pollutants to travel long distances in extremely short time intervals. Thus, a potential exists for polluting vast quantities of ground water in alluvium filled basins in the Southwest. Ephemeral channels allow a buildup of manure, bacteria, and other pollutants on the soil surface and also at shallow depths. This accumulation increases until a runoff-producing storm of sufficient size carries it downslope, with a portion of it eventually infiltrating to ground water. Land usage practices contribute to the ground water pollution. (Moore-SRC)
W81-06127

SEWAGE SLUDGE VIRAL AND PATHOGENIC AGENTS IN SOIL-PLANT-ANIMAL SYSTEMS,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
For primary bibliographic entry see Field 5E.
W81-06131

REACTION PRODUCTS FROM THE CHLORINATION OF SEAWATER,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
J. H. Carpenter, C. A. Smith, and R. J. Zika.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-172280, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-81-010, May, 1981. 4 p, 4 Fig, 8 Ref.

Descriptors: *Seawater, *Chlorination, *Wastewater treatment, Halogenated compounds, Wastewater, Water pollution, Estuarine environment, Effluents, Bromine, Oxidants, Coastal waters.

Measurement of the residual oxidants in the waters discharged from wastewater treatment plants and electricity generating plants has become important for assessment of environmental impact. The wastewater collection systems of many coastal communities contain some seawater as a result of infiltration with brackish groundwater, and chlorine added as a disinfectant during treatment reacts with the seawater constituents during treatment and in the receiving water. Some analytical methods underestimate the residual oxidants in chlorinated seawater by as much as 70% depending upon the detail of the procedures. The chlorination of seawater in the presence of light produces substantial quantities of bromate ions which can influence standard analytical procedures and represents an unknown factor in estuarine and coastal waters. The toxicity of bromate ion and the possibility of bromate as a persistent source of brominated compounds in coastal waters needs to be determined. The copper complexing capacity of Biscayne Bay, Florida was found to be substantially reduced with the addition of chlorine. Laboratory chlorination of water from the intake of the Port Everglades, Florida power plant produces bromoform levels comparable to those found in the plant discharge. Chloroform extracts of chlorinated Biscayne Bay water are found to contain halogenated compounds which are new and different, and which pose unusual analytical problems. (Moore-SRC)
W81-06134

AQUATIC IMPACTS OF DEICING SALTS IN THE CENTRAL SIERRA NEVADA MOUNTAINS, CALIFORNIA,
Ch2M/Hill, Inc., San Francisco, CA.
For primary bibliographic entry see Field 2H.
W81-06179

CELLS-IN-SERIES SIMULATION OF RIVER-INE TRANSPORT,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 6A.
W81-06198

ACID PRECIPITATION: CRUCIAL QUESTIONS STILL REMAIN UNANSWERED,
For primary bibliographic entry see Field 5C.
W81-06228

ENRICHMENT OF SULPHATE IN MARITIME AEROSOLS,
Atomic Energy Research Establishment, Harwell (England).
J. A. Garland.
Atmospheric Environment, Vol 15, No 5, p 787-791, May, 1981. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Sulfates, *Marine environment, Seawater, Sodium, Sprays, *Aerosols, Pollution sources.

Seawater was collected from the Dorset coast and subjected within two or three days to analysis of the content of sulfate ions, relative to sodium. The results for sea water freshly labeled with 35S-sulfate ion and for sea water labeled several days previously indicated that there was no evidence for a further enhancement of transfer of 35S to the aerosol from sea water which had been stored, and the best estimate of the mean enrichment ratio was therefore obtained by bulking the data from the separate experiments. An enrichment of sulfate relative to sodium of only 10 to 30% was noted over a wide range of particle sizes. The experiments were designed to simulate the process of spray production at sea in only a semi-quantitative fash-

ion. The bubbles were unlikely to have the size distribution occurring at sea, and consequently the size distribution of the resulting particles may be unrepresentative. However, a wide range of particle size was present in the experiments, and there was no consistent indication of a variation of enrichment ratio for sulfate with particle size. It seems unlikely that enrichment of sulfate at sea in sea spray could differ much from the range of 1.1 to 1.3 observed in these experiments. It is suggested that the usual method for calculating the sea spray contribution to sulfate measured in air and rain samples results in a small underestimation. (Baker-FRC)
W81-06230

ENHANCED OIL-RECOVERY AND ITS ENVIRONMENTAL AND ECONOMIC IMPLICATIONS IN THE UNITED STATES,
Campbell Co., Inc., Los Angeles, CA.
D. A. Campbell.
Environmental Conservation, Vol 8, No 1, p 5-18, Spring, 1981. 3 Fig, 3 Tab, 25 Ref.

Descriptors: *Groundwater pollution, *Oil recovery, *Chemical treatment, Oil industry, Microorganisms, Drinking water, Water pollution sources, Oil pollution.

Enhanced oil-recovery processes are described, and their impacts on water and air pollution are discussed. Methods include thermal processes such as steam injection, miscible and semi-miscible processes, chemical processes, and microbiological processes. These processes have fewer environmental side-effects than synthetic fuel production, but chemical processes do threaten groundwater quality. Chemicals injected into deep oil reservoirs may migrate, and there is danger of contamination from polymers, alkalines, and micellar polymers. Another problem associated with these processes is increased consumption of water, which may affect the biology of an area. For example, drawing-down water on the coastal plains could increase saltwater intrusion or alter wetland communities. Enhanced oil-recovery processes could involve two-thirds of all oil already identified in the US and assumed to be unrecoverable by primary or secondary means. More research is needed to develop safeguards to ensure that drinking water is not contaminated by chemical processes. (Small-FRC)
W81-06245

SNOW AND ICE CONTROL AND THE TRANSPORT ENVIRONMENT,
Toronto Univ. (Ontario).
P. H. Jones.
Environmental Conservation, Vol 8, No 1, p 33-38, Spring, 1981. 3 Fig, 20 Ref.

Descriptors: *Deicers, *Highway icing, *Salts, Environmental effects, Ice formation, Ice, Highways, Sodium chloride, Calcium chloride, Verglimit, Corrosion, Groundwater pollution, Canada.

Procedures for maintaining ice-free roads in the winter are discussed, with emphasis on the use of salt and its effects on the environment. Common salt or NaCl is most generally used, but calcium chloride (CaC12) and the defroster Verglimit can also be used. While all three chemicals can reduce the hazard on freezing roads, they pose environmental problems as possible ground and surface water hazards to humans. Also, they are corrosive to vegetation and highways. Verglimit is a multi-chemical defroster which is included in the top course of an asphalt surface and releases a continuous CaC12 brine. It can control ice formation even at very low temperatures. Disadvantages include its high cost and the lack of experience with the defroster and its application in Canada. Verglimit could be used on highly hazardous sections of highway which would reduce general maintenance cost. This solution should also reduce corrosion and excess salt in the environment. (Small-FRC)
W81-06247

STUDIES ON THE DEGRADATION OF ATRAZINE BY BACTERIAL COMMUNITIES ENRICHED FROM VARIOUS BIOTOPES,
Konstanz Univ. (Germany, F.R.). Dept. of Biology.
A. Geller.
Archives of Environmental Contamination and Toxicology, Vol 9, No 3, p 289-305, May, 1980. 6 Fig, 5 Tab, 37 Ref.

Descriptors: *Atrazine, *Microbial degradation, *Herbicides, *Fate of pollutants, Degradation, Bacteria, Nutrients, Metabolites, Degradation products, Biodegradation, Path of pollutants, Decomposition.

Atrazine, 2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine, a relatively persistent herbicide, degrades primarily by physiochemical means rather than by microbial degradation. C-14 ring labeled atrazine incubated in sterile 0.02M phosphate buffer and mineral salt medium, pH 7.2, formed 0.6% Cl-deethyl- and 0.1% Cl-deisopropyl atrazine after two weeks. Degradation products produced over a three month period are described in detail. Bacterial degradation was strongly influenced by nutrient supply, but not by origin of bacteria (from soil, waters, and activated sludges). Of 33 mixed populations of bacteria, 31 converted atrazine into unidentified compounds. High nutrient levels produced a constant level of 17-57% metabolites after one or two weeks; low nutrient levels, 7-57% after one week. During the second week of incubation, metabolite levels dropped and atrazine levels increased correspondingly, indicating a bound state simulating biodegradation. Levels of dealkylated metabolites were similar in both sterile solutions and bacterial cultures. (Cassar-FRC)
W81-06258

FLUXES OF ARSENIC, LEAD, ZINC, AND CADMIUM TO GREEN BAY AND LAKE MICHIGAN SEDIMENTS,
Wisconsin Univ., Milwaukee. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W81-06280

HEAVY-METAL POLLUTION OF LAKES MICHIGAN, ERIE, AND ONTARIO,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 2H.
W81-06283

A DIFFUSION EXCHANGE MODEL FOR SOLUTE MOVEMENT IN FISSURED POROUS ROCK,
Institute of Geological Sciences, Wallingford (England).
J. A. Barker, and S. S. D. Foster.
Quarterly Journal of Engineering Geology, Vol 14, No 1, p 17-24, 1981. 7 Fig, 18 Ref.

Descriptors: *Solute transport, *Groundwater movement, *Model studies, Diffusion coefficient, Chalk, Mathematical models, Porosity, Porous media, *Path of pollutants, Tracers.

A mathematical model was developed to gain a detailed insight into the behavior of a diffusion exchange mechanism for solute transport in fissured porous media and to establish the extent to which the 'chromatographic' equilibrium approximation was valid. The model was further developed to aid in the interpretation of tritium, nitrate, and other solute profiles of pore waters from the Chalk's unsaturated zone. The model detailed solute movement in an idealized, fissured, porous medium, involving diffusion exchange between mobile fissure water and immobile pore-water, for a range of values of various input parameters. The results of the model, applied to such carbonate aquifers as the Chalk, indicate that once solutes (pollutants) enter the Chalk matrix by some mechanism, it would take a very long time for them to be completely eluted out. Conversely, newly-introduced pollutants in the fissure water may not be significantly attenuated, in their horizontal movement, by the diffusion exchange mechanism. Moreover, from tracer experimentation using water-soluble, non-reactive salts to evaluate groundwater dispersion coefficients, results will probably be produced that will vary with the local hydraulic gradient, as this will control fissure-flow velocity and in turn the extent to which diffusion exchange with the matrix will occur. (Baker-FRC)
W81-06315

PROCESSING WASTEWATER FROM TWO MECHANIZED SALMON CANNERIES,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
F. E. Stone, H. J. Barnett, P. J. Hunter, G. C. Roberts, and R. W. Nelson.
Marine Fisheries Review, Vol 43, No 1, p 21-25, January, 1981. 5 Fig, 3 Tab.

Descriptors: *Canneries, *Salmon, Fish, Industrial effluents, Effluents, Industrial plants, Industrial wastes, Water quality.

Intraday and daily variations in the composition of wastewater from two West Coast mechanized salmon canneries were measured and compared. Relationships between the amount of processing waste discharged, daily production, water used, and the biological oxygen demand, total suspended solids, and oil and grease concentrations of the wastewater were determined. Long-term average and daily maximum discharges expected at each level of production were calculated and compared with the EPA recommended guidelines. Both canneries used water more efficiently as production increased. The composition of the untreated wastewater from both canneries was very similar. The concentration of waste in the samples from both canneries followed similar distribution curves at all levels of daily water use and production investigated. Both canneries discharged less BOD5, TSS and oil and grease per unit of production on high-production than on low-production days. Both canneries complied with EPA recommended effluent limitations more frequently as daily production increased. (Baker-FRC)
W81-06325

MERCURY ACCUMULATION IN FISH AND INVERTEBRATES OF THE NORTH FORK HOLSTON RIVER, VIRGINIA AND TENNESSEE,
Oak Ridge National Lab., TN.
S. G. Hildebrand, R. H. Strand, and J. W. Huckabee.
Journal of Environmental Quality, Vol 9, No 3, p 393-400, July/September, 1980. 4 Fig, 6 Tab, 48 Ref.

Descriptors: *Mercury, *Fish, Accumulation, Rivers, *North Fork Holston River, Tennessee, Virginia, Invertebrates, Monitoring, Industrial wastes, Chemical industry, Industrial plants.

Fish and benthic invertebrates were collected at four stations in August of 1974 and at seven stations in August of 1975 from the North Fork of the Holston River, above and below a currently inactive chlor-alkali plant. Total mercury concentration in fish and benthic invertebrates decreased with the distance below the plant. Significant linear regressions of total mercury concentration on fish weight were noted for some, but not all, samples examined. Mercury in the methyl form comprised 91.7% of total mercury in the fish analyzed, while about 50% of the mercury in invertebrates was methylmercury. Multiple regression analysis indicated that 96.4% of the variance in total mercury concentration in rock bass and 80.5% in hog suckers was accounted for by mercury in water, sediment, and benthic invertebrates. Independent variables accounted for 97.4% of the variance in total mercury concentration in benthic invertebrates. (Baker-FRC)
W81-06326

TRACING FLOCCULENT INDUSTRIAL AND DOMESTIC SEWAGE TRANSPORT ON SAN PEDRO SHELF, SOUTHERN CALIFORNIA, BY NITROGEN AND SULPHUR ISOTOPE RATIOS,
California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
R. E. Sweeney, and I. R. Kaplan.

Marine Environmental Research, Vol 3, No 3, p 215-224, July, 1980. 4 Fig, 3 Tab, 16 Ref.

Descriptors: *Flocculation, *Outfall sewers, *Isotope studies, Wastewater treatment, Water pollution sources, *Wastewater outfall, Nitrogen, Sulfur, Calcium carbonate, San Pedro Shelf, *California.

Studies were conducted to determine whether flocculent material found in shallow rocky areas near a domestic and industrial sewage outfall was of sewage origin. Domestic and industrial sewage is discharged at a depth of 60 m on the San Pedro Shelf in Southern California. If the flocculent material found in the area was of sewage origin, it could have a detrimental effect on the growth of brown algae or filter-feeding benthic fauna. Sixteen samples of flocculent material were collected across the shelf, and the 15N/14N ratio was determined. Analyses of the contents of calcium carbonate, organic carbon, nitrogen, and sulfur and the 34S/32S ratio were performed. Flocculent material was found at depths of 7, 13, and 20 m. Organic nitrogen at 20 m was predominantly of sewage origin, and at 7 m it was predominantly or marine origin. Organic nitrogen at 13 m and within 3 km of the outfall was predominantly of sewage origin. When the flocculent material contained the stable isotopic composition of sulfur, it indicated that the effluent particles contained metabolic sulfur from seawater as well as bacterially produced mineral sulfide. (Small-FRC)
W81-06332

OCCURRENCE AND PREDICTION OF ACID DRAINAGES,
South Carolina Univ., Columbia. Dept. of Geology.
F. T. Caruccio, G. Geidel, and M. Pelletier.
Journal of the Energy Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EY1, p 167-178, May, 1981. 4 Fig, 3 Tab, 10 Ref.

Descriptors: *Acid mine drainage, *Acid rain, *Leachates, *Carbonate rocks, *Runoff, Mine drainage, Acid streams, Leaching, Calcium carbonate, Sulfur, Magnesium carbonate, Weathering, Simulated rainfall, Rocks, Rock properties, Neutralization, Calcareous soils, Minerals.

The capability of rock to produce acid leachate depends on both its sulfur and calcareous material content. These two components were considered along with leaching tests to evaluate the production of acid or alkaline leachate by a stratum. Calcareous material in rock samples served to inhibit pyrite oxidation and neutralize acidity produced. Samples with critical sulfur-calcareous material constituents generated acid after leaching for prolonged periods with an acid solution. When leachate characteristics were plotted against sulfur and calcareous material content, a clustering of samples in two distinct groups occurred. Samples with a neutralizing potential of more than 15 mg of calcium carbonate equivalent/g and sulfur levels of less than 0.5% usually produced alkaline leachates, whereas samples with NP values of less than 2 mg of calcium carbonate equivalent/g and sulfur levels over 1.5% generally produced acidic leachates. When critical calcareous material-sulfur ratios occur, valid predictions of leachate properties are not always possible. During hot acid digestion, minerals other than calcium and magnesium carbonate are degraded and may appear in the NP column. A cold acid digestion method is presented which relates empirically derived weathering trends to whole rock studies to predict potential leachate quality. Simulated acid rain had little effect on the acceleration of acid production from the samples. (Geiger-FRC)
W81-06336

STABILITY OF SIMIAN ROTAVIRUS IN FRESH AND ESTUARINE WATER,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
C. J. Hurst, and C. P. Gerba.
Applied and Environmental Microbiology, Vol 39, No 1, p 1-5, January, 1980. 2 Fig, 18 Ref.

Descriptors: *Viruses, *Natural waters, Estuarine environment, Coasts, Poliovirus, Echovirus, Coxsackievirus, Rotavirus, Water pollution, Seasonal variation, Human diseases, Enteroviruses, Wastewater treatment facilities, Wastewater outfalls, Effluents.

The objective of this study was to determine whether rotaviruses were able to survive long enough in surface waters to pose a public health problem if they escape inactivation during the sewage treatment process and are discharged into effluent receiving waters. The rates of inactivation of poliovirus 1, echovirus 7, coxsachievirus B3, and simian rotavirus SA11 were compared in polluted and nonpolluted fresh and estuarine water samples. The study was done in two parts, comparing virus survival in samples taken 1 year apart from the same site. The survival studies were performed at 20 degrees C and at the natural pH of the water samples. In the first part of the study, the time required for a 3-log-10 reduction in the initial virus titers was 2 to 3 days in the estuarine water samples, and varied from 3 to more than 14 days in the freshwater samples. In the second part of the study no clear distinction was found between survival of viruses in freshwater samples and survival in estuarine water samples. The time required for a 3-log-10 reduction in the initial virus titers in the second part of the study varied from 12 to more than 14 days. This indicates that there is a nonseasonal change in factors in the water which influence virus survival. SA11 survival time was well within the range exhibited by the enteroviruses, indicating that it also is environmentally stable in natural waters. (Baker-FRC)
W81-06346

THE HYDROGEOCHEMISTRY OF THE JURASSIC LIMESTONES IN GLOUCHESTERSHIRE, ENGLAND,
Thames Water Authority, Reading (England).
For primary bibliographic entry see Field 2F.
W81-06352

EXPERIMENTAL INSIGHT OF TRACE METAL ENVIRONMENTAL POLLUTION PROBLEMS IN MUSSEL FARMING,
Universiti Sains Malaysia, Penang. School of Biological Sciences.
P. M. Sivalingam, and B. Bhaskaran.
Aquaculture, Vol 20, No 3, p 291-303, July, 1980. 2 Fig, 3 Tab, 29 Ref.

Descriptors: *Trace metals, *Mussels, *Aquaculture, *Absorption, *Pollutant identification, Mollusks, On-site investigations, Coastal waters, Pollution load, Sublethal effects, Toxicity, Shellfish, Accumulation, Cultures, Biochemistry, Physiological ecology.

Trace metals pollution in mussel farming was investigated and three surveys were conducted. A survey of nine trace metals in coastal waters of 12 stations in Malaysia revealed low concentrations of most elements. Chromium and nickel concentrations ranged from trace level to 35 ppm and 2.07 ppm, respectively. These were the highest concentrations observed, and are slightly above the nationally established upper limits. Investigations of tissue ion accumulation in mussels were conducted at an experimental culture farm. Short-term stress studies over a 48 hour test period with trace metal concentrations ranging from 10 to 300 ppm indicated the patterns of biodeposition for cadmium, chromium, cobalt, lead, manganese, and zinc to be closely related, even though their toxicity levels varied. Results suggest that the mussel may be useful as a bioindicator for cadmium, cobalt, chromium, copper, nickel and lead contamination, but not for iron, manganese or zinc, elements for which a low bioaccumulation factor was exhibited. (Titus-FRC)
W81-06353

ALUMINUM IN GROUNDWATER: POSSIBLE SOLUTION EQUILIBRIA,
Uppsala Univ. (Sweden). Div. of Hydrology.
E. Eriksson.
Nordic Hydrology, Vol 12, No 1, p 43-50, 1981. 3 Fig, 1 Tab, 16 Ref.

Descriptors: *Aluminum, *Acid rain, *Groundwater pollution, Chemical analysis, Rocks, Water pollution sources, Soils, Air pollution effects, *Sweden.

The chemistry of inorganic aluminum compounds in soils and rocks below pH 7.5 was reviewed because of high concentrations of aluminum found in acid groundwater on the west coast of Sweden. Acid precipitation falls in this area, so the solubility of aluminum compounds contained in soils and rocks is of interest. Studies are cited on the chemistry of hydroxides, Al-silicate minerals, amorphous aluminum silicates, and basic aluminum sulfate. The chemical analysis of acid groundwater is discussed, based on two sets of experimental data. The acidification process probably proceeds as follows. When precipitation turns acid, this attacks the cation exchange reservoir in the soil. When this is depleted, aluminum hydroxides are attacked, and when sulfate concentrations are high enough, aluminum oxides are transformed into basic sulfates. When the process has continued long enough, aluminum reaches the groundwater table. (Small-FRC)
W81-06359

5C. Effects Of Pollution

WATER QUALITY PROBLEMS: PERMITTING DISCHARGES FROM HYDROELECTRIC DAMS UNDER THE CLEAN WATER ACT,
Arnold and Porter, Washington, DC.
For primary bibliographic entry see Field 6E.
W81-06116

TOXICITY OF AN IN SITU OIL SHALE PROCESS WATER TO RAINBOW TROUT AND FATHEAD MINNOWS,
Wyoming Univ., Laramie. School of Pharmacy.
A. D. Anderson, M. E. Lebsack, G. M. DeGraeve, D. S. Farrier, and H. L. Bergman.
Archives of Environmental Contamination and Toxicology, Vol 9, No 2, p 171-179, March, 1980. 6 Tab, 23 Ref.

Descriptors: *Fish, *Inorganic compounds, *Oil shale, *Trout, Fathead minnows, Industrial wastewater, Fish eggs, Ammonia, Organic compounds, Salts, Toxicity, Water quality, *Water pollution effects, Process water, Rainbow trout, Fathead minnows.

Flow-through bioassay tests were used to determine the toxicity of an in situ oil shale process water, designated Omega-9, on fathead minnows, rainbow trout, and rainbow trout eggs. The 96-hour LC50 dilutions in 2 separate determinations were 0.51% and 0.41% for rainbow trout. Fathead minnows were slightly less sensitive, with a 96-hour LC50 of 0.56%. Rainbow trout eggs hatched in 0.16% process water produced significantly shorter fry than eggs hatched in control water. A solution of 13 of the major inorganic constituents of Omega-9 had a 96-hour LC50 of 0.56% for rainbow trout and 1.12% for fathead minnows. Removing the inorganic constituents, especially ammonia, would considerably reduce the toxicity of the oil shale process water. Total organic carbon of this water sample was 1003 mg per liter and consisted primarily of polar compounds such as carboxylic acids. Ammonia concentration was 3.8 grams per liter. (Cassar-FRC)
W81-06161

EFFECTS OF ABNORMAL THERMAL STRATIFICATION ON A RESERVOIR BENTHIC MACROINVERTEBRATE COMMUNITY,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
C. M. Cooper.
American Midland Naturalist, Vol 103, No 1, p 149-154, January, 1980. 4 fig, 16 Ref.

Descriptors: *Water level, *Stagnant water, *Thermal stratification, *Reservoirs, Benthic fauna, Invertebrates, Flooding, Productions, Ecosystems, Water pollution effects, *Ecological effects.

Changes in macroinvertebrate abundance were measured during drawdown-dependent stagnation of the Grenada Reservoir, Mississippi. Samples of bottom deposits were collected monthly, and physical characteristics such as dissolved oxygen, pH, conductivity, and temperature were measured. During the experimental period, flooding caused abnormally high water levels. These increased water levels resulted in prolonged abnormal hypoliminal stagnation due to lack of normal drawdown procedures. In 1973, this stagnation caused massive kills of immature Hexagenia bilineata and Oecetis inconspicua larvae in the reservation conservation pool. The lengthy stagnation changed the benthos community. Hexagenia and Oecetis could not be recolonized. Thus, the Hexagenia-Oecetis-Chaoborus-Chironomidae community was replaced by a Limnodrilus-Chaoborus-Chironomidae community. Initially production decreased, but it later recovered. Monitoring of benthic communities is useful in evaluating environmental stress such as that caused by abnormally high water levels. (Small-FRC)
W81-06178

ROOTED AQUATIC PLANT EFFECTS ON NITROGEN BUDGETS,
DuBois and King, Inc., Randolph, VT.
K. I. Trask, J. C. O'Shaughnessy, and F. C. Blanc.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE3, p 481-492, June, 1981. 5 Fig, 1 Tab, 18 Ref.

Descriptors: *Aquatic plants, *Nitrogen removal, *Rivers, Water quality, Denitrification, Accumulation, Flow, Sediments.

Nitrogen was investigated as the critical nutrient in rooted aquatic plants, and the relationship of the plant biomass to the water nitrogen budget was studied. Over a 2-year period, 18 river surveys were used to establish water quality of the Assabet River in Massachusetts. During the second year, rooted aquatic samples were collected on a biweekly basis during the growing season. Plant samples were analyzed for NH4-N uptake, and plant dry weight and nitrogen content were determined. Plant biomass incorporated only a small portion of the total available ammonia; no more than 8% of the cumulative total ammonia was used as plant tissue. Generally, 1 to 3% of the available ammonia may have been used. Nitrogen concentration and macrophyte mapping indicated that the locations of plant growth were influenced by sediment type and flow regime. Total nitrogen removal by rooted aquatic plants was a function of the standing crop size. A maximum density will be achieved when 0.05 lb available nitrogen/sq m of plant exists. (Small-FRC)
W81-06187

WIND-DRIVEN FLOW IN MISSISSIPPI RIVER IMPOUNDMENT,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
H. Stefan, and K. J. Anderson.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY9, p 1503-1520, September, 1980. 9 Fig, 3 Tab, 8 Ref.

Descriptors: *Reservoirs, *Flow pattern, Wind, Mississippi River, Rivers, *Nuclear powerplants, Powerplants, Hydraulics, River flow, Radioactive wastes, Effluents, Wind-driven currents, *Minnesota, Prairie Island Nuclear Power Plant.

A mathematical model was constructed of the flow distribution and the exchange of water in Pool No. 3 of the Prairie Island Nuclear Power Generating Plant on the Minnesota shore of Pool No. 3. This plant supplies electric power for the Twin Cities and other areas. The model was mainly intended to determine the amount of flow through Sturgeon Lake and the backwater channels in the vicinity of the plant. This information was needed to determine how much, if any, of the outflow from Sturgeon Lake was drawn into the cooling water intake of the power plant and how that flow varied in time. Additional water dilutes the plant effluent cooling water, the blowdown water, and the periodic releases of low level liquid radioactive wastes before they enter the Mississippi mainstem. The results of the study clearly show the significance of wind speed and wind direction on water circulation during low riverflow conditions. (Baker-FRC)
W81-06194

ANNUAL PRODUCTIVITY AND PHYTOPLANKTON CHANGES BETWEEN 1969 AND 1974 IN GULL LAKE, MICHIGAN,
Michigan State Univ., Hickory Corners. W. K. Kellog Biological Station.
For primary bibliographic entry see Field 2H.
W81-06197

DRINKING WATER SODIUM AND BLOOD PRESSURE IN CHILDREN: A SECOND LOOK,
Massachusetts Univ., Amherst. Dept. of Public Health.
R. W. Tuthill, and E. J. Calabrese.
American Journal of Public Health, Vol 71, No 7, p 722-729, July, 1981. 1 Fig, 2 Tab, 49 Ref.

Descriptors: *Sodium, Blood, *Public health, Public waters, *Drinking water, Potable water, Salts, *Blood pressure, Diets, Comparison studies.

A statistically significant and clinically important elevation of 3-5 mm Hg in mean systolic and diastolic blood pressure was found in high school sophomores in a community with 108 mg/L of sodium in the water supply when compared to their peers in an appropriately matched community with 8 mg/L sodium in their drinking water. These findings were reported in an earlier paper by these authors. Current studies with third graders in these same two communities gave similar findings. This second look considered dietary intake and urinary excretion of sodium. As the difference in 24 hr dietary sodium consumption was 300 milligrams between the communities, an intake of one liter of high sodium tap water represented about 25% of the difference in total sodium intake between the two communities. It is suggested by these findings that sodium consumption in both drinking water and diet may contribute to the difference in blood pressure distributions among the normotensive children in the two communities. (Baker-FRC)
W81-06226

DRINKING WATER SODIUM AND BLOOD PRESSURE: A CAUTIOUS VIEW OF THE 'SECOND LOOK',
Boston City Hospital, MA. Channing Lab.
W. C. Willett.
American Journal of Public Health, Vol 71, No 7, p 729-732, July, 1981. 18 Ref.

Descriptors: *Sodium, Blood, Public health, Public waters, *Drinking water, Potable water, Salts, *Blood pressure, Comparison studies.

Evidence is examined which relates to the hypothesis that drinking water sodium causes a clinically important elevation in blood pressure among school children. A study performed by Tuthill and Calabrese is reviewed. In that study it was indicated that blood pressure levels in third grade children in a high drinking water sodium community were 3-5 mm Hg higher than those of children living in a contiguous community with low drinking water sodium. However, it is concluded that the drinking water sodium-blood pressure hypothesis is not adequately proved by this study, as chance and other factors played a significant role. The possibility of observer bias, potentially confounding variables associated with the community, and dietary intake of sodium all were significant factors in this study. It is suggested that the results of this earlier study be accepted only with greatest caution. Data relating moderate changes in sodium intake to changes in blood pressure among general population groups, and especially among children, are extremely inadequate. In commenting on the public health aspects of a possible relationship it is noted that less than 5% of the American water supplies contain more than 250 mg sodium per liter. Thus the proportion of sodium contributed by drinking water to the average American intake is small, almost always less than 10%. Overall knowledge does strongly suggest that large changes in sodium intake do affect blood pressure, at least in some individuals. (Baker-FRC)
W81-06227

ACID PRECIPITATION: CRUCIAL QUESTIONS STILL REMAIN UNANSWERED,
T. Kish.
Journal of the Water Pollution Control Federation, Vol 53, No 5, p 518-521, May, 1981. 2 Fig.

Descriptors: *Hydrogen ion concentration, *Acid rain, Algae, Phytoplankton, Rainfall, Air pollution, Nitrates, Sulfates, Sulfuric acid, Nitric acid, Hydrochloric acid, Acidic water, Lakes, Fish, Toxicity.

Information currently available concerning acid precipitation is reviewed, with specific attention given to various control measures under consideration. Precipitation found preserved in 350 yr old ice cores of glaciers and continental ice sheets has been shown to be generally above pH 5. Ice originating as snow 150 years ago in Greenland has a pH ranging from 6 to 7.6. The earliest known pH record obtained in the US was made in Brooklyn, Maine in 1939 and showed a pH value of 5.9. In the early 1950's rain was falling with pH values in the low 5's. The acidic portion in rainfall in the eastern US has been analyzed to be about 62% sulfuric acid and 32% nitric acid, with 6% other acids including hydrochloric acid. Sulfur and nitrogen acids derive from the burning of coal and oil. While sulfate and nitrate emissions have increased during 1960-1970, there has been no apparent trend toward a corresponding increase in the acidity of precipitations during that time. No seasonal variations have been noted, even though sulfate and nitrate emissions are higher in the summer time. Acid rain samples have been collected in remote areas of the world. The relationship of acid precipitation to lake acidity is not well understood. The relative importance of other acid inputs is not well defined. The Canadian Ministry of Environment estimates that about 60,000 lakes are degraded or endangered due to acid precipitation. Norway estimated 20,000 of its lakes are endangered. Low pH levels can release heavy metals from soils into the lakes, further complicating the situation. Acid lakes experience changes in algal populations. While solutions for reducing acid rain problems are not clear, the desire to do so is wide spread. (Baker-FRC)
W81-06228

ACUTE IMPACT OF AN ORGANOPHOSPHORUS INSECTICIDE ON MICROBES AND SMALL INVERTEBRATES OF A MANGROVE ESTUARY,
Georgia Univ., Sapelo Island. Marine Inst.
S. Y. Newell, K. E. Cooksey, J. W. Fell, I. M. Master, and C. Miller.
Archives of Environmental Contamination and Toxicology, Vol 10, No 4, p 427-435, July, 1981. 3 Tab, 52 Ref.

Descriptors: *Ecological effects, *Fenthion, *Mangrove swamps, Water pollution effects, Aquatic habitats, Aquatic life, *Organophosphorus pesticides, Larvicides, Insecticides, Pesticides, Invertebrates, Copepods, Fungi, Nitrogen fixing bacteria, Bacteria, Microorganisms, Ecosystems, Diatoms, Zooplankton.

The effects of 24 to 72 hour exposures to fenthion, O,O-dimethyl O-(3-methyl-4-(Methylthio) phenyl) phosphorothioate, in concentrations up to 2250 ppb were determined for inhabitants of a mangrove estuary. Growth of the native fungi, Phytophthora vesicula, on black and brown fallen leaves was not affected after 24 hours exposure to fenthion, but P. spinosa showed a slight decrease in growth in brown leaves at the higher concentrations, 0.23 and 2.25 ppm. Fenthion did not depress nitrogen fixation or the growth of the benthic diatom, Amphora coffeaeformis var. perpusilla, at levels up to 500 ppb. A 24 hour exposure to fenthion at concentrations as high as 500 ppb did not produce significant mortality to Diplolaimelloides delyi, a nematode, or Microlaphonate trise-

tosa, a harpacticoid copepod at the 500 ppb level. The planktonic copepod, Acartia tonsa, showed 50% mortality in a 72 hour exposure of 500 ppb. Fenthion, fatal to mosquito larvae at concentrations of 5-25 ppb, could be used in the mangrove ecosystem without adversely affecting the nontarget organisms. (Cassar-FRC)
W81-06231

THE LIMITING ROLE OF PHOSPHORUS IN A WOODLAND STREAM ECOSYSTEM: EFFECTS OF P ENRICHMENT ON LEAF DECOMPOSITION AND PRIMARY PRODUCERS,
Oak Ridge National Lab., TN.
J. W. Elwood, J. D. Newbold, A. F. Trimble, and R. W. Stark.
Ecology, Vol 62, No 1, p 146-158, February, 1981. 7 Fig, 2 Tab, 72 Ref.

Descriptors: *Phosphorus compounds, *Leaves, *Algae, *Decomposition, Nutrients, Phosphates, Nitrogen compounds, Decomposing organic matter, Detritus, Invertebrates, Streams, Benthic fauna, Degradation, Biodegradation, Chlorophyll a, Snails, Respiration, Water pollution effects, Microbial degradation, Aquatic life, Ecological effects.

The limiting role of phosphorus on leaf decomposition and primary producers was studied in Walker Branch, a second-order woodland stream in Tennessee, by enriching stream sections with an average of 60 and 450 micrograms phosphate-P per liter for 95 days. The control level was 4 micrograms per liter P. Leaf packs (6-7 grams of air dried red oak leaves in nylon net bags) placed in the enriched sections lost mass 24% faster than control packs. Nitrogen content of the enriched packs increased 60% more and P, 83%, than in the control packs. No significant differences in mass loss and N and P levels were seen in the two different P-enriched areas. Maximum mean respiration rates of leaf discs were highest at 60 days: control, 280 microliters per g per hour oxygen consumption; low P-enriched, 300; and high P-enriched, 400. More leaf mass was lost in the enriched sections, suggesting faster microbial conditioning and/or increases in macroinvertebrate feeding. Enrichment produced increased chlorophyll a levels followed by increases in biomass. Dense growths of other algae occurred immediately downstream of P inputs: Oscillatoria, a possible nitrogen-fixer, and Nostoc, a known nitrogen-fixer. Gonobasis clavaeformis, a snail, was also more numerous in enriched waters. These results suggest that nutrient limitation of detrital processing is a significant factor in natural streams and affects the higher trophic levels. (Cassar-FRC)
W81-06244

EFFECT OF TEMPERATURE ON ACTIVITY OF PREDATORS OF SALMONELLA TYPHIMURIUM AND ESCHERICHIA COLI IN ESTUARINE WATER,
Tasmania Univ., Hobart (Australia). Dept. of Agricultural Science.
For primary bibliographic entry see Field 2L.
W81-06256

PERSISTENCE OF THREE ORGANOPHOSPHORUS INSECTICIDES IN ARTIFICIAL PONDS AND SOME BIOLOGICAL IMPLICATIONS,
York Univ., Downsview (Ontario). Dept. of Biology.
D. N. Hughes, M. G. Boyer, M. H. Papst, C. D. Fowle, and G. A. V. Rees.
Archives of Environmental Contamination and Toxicology, Vol 9, No 3, p 269-279, 1980. 5 Fig, 2 Tab, 24 Ref.

Descriptors: *Organophosphorus pesticides, *Pesticide residues, *Ponds, Fate of pollutants, Abate, Reldan, Dursban, Insecticides, Cladocerans, Copepods, Invertebrates, Eutrophication, Adsorption, Degradation, Aquatic life, Algae, *Ecological effects, Artificial ponds, Linings, Polyethylene.

The persistence and biological effects of three organophosphorus insecticides, Abate, Reldan, and Dursban, were studied in artificial polyethylene-lined ponds and a natural pond inoculated with leaf litter. Dursban was most persistent, followed by Reldan and Abate. The times for 90% of the pesticides to disappear from the water (concentrations, 10 ppb active ingredient) were Dursban, 2.3-10 days for the plastic-lined ponds and 1.6 days for the natural pond; Reldan, 1.2 days; and Abate, 1.05 days. Extrapolation of the Dursban data predicted 40-200 days for degradation to 0.01 ppb in polyethylene-lined ponds and 18 days in the natural pond. Pesticides were initially adsorbed on bottom sediments and polyethylene. Residual levels were higher in polyethylene-lined ponds due to desorption from the plastic. Cladocerans were completely killed within 24 hours, with no recovery in Dursban or Abate ponds up to 40 days. In Reldan ponds, cladocerans had recovered by 25-30 days after treatment. Cyclopod and calanoid copepods and copepod nauplii were less sensitive. Chlorophyll concentrations were greater in Abate and Dursban ponds than in untreated ponds, supporting the conclusion that elimination of predator zooplankton promotes algal growth. (Cassar-FRC)
W81-06257

EVALUATING PROMULGATED REFINERY EFFLUENT STANDARDS USING ARTIFICIAL STREAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
R. A. Honig, and A. L. Buikema, Jr.
Archives of Environmental Contamination and Toxicology, Vol 9, No 5, p 607-618, September, 1980. 2 Fig, 4 Tab, 43 Ref.

Descriptors: *Oil wastes, *Oil refineries, *Algae, *Effluent standards, Water pollution effects, Standards, Periphyton, Taxonomy, Biomass, Growth rates, Industrial wastes, Environmental effects, Eutrophication.

Artificial Refinery Mixture (ARM), representative of oil refinery effluents, was tested on periphyton communities on glass slides in laboratory streams, using nontaxonomic structural parameters--ash-free dry weight, chlorophyll a, and ATP. Concentrations one to five times full strength stimulated periphyton colonization rates. Concentrations of 0.25 to five times caused a shift in dominant periphyton algae from diatoms to green algae and a higher pH level in reference streams, related to photosynthetic activity. The non-taxonomic parameters were not sensitive water quality indicators because taxonomic shifts occurred at ARM concentrations of 0.25 to 0.5 times full strength without changing ATP, chlorophyll a, and ash-free dry weight. Dry weight results were generally obscured by a high level of suspended solids in ARM. (Cassar-FRC)
W81-06259

FLUX OF AROCLOR 1254 BETWEEN ESTUARINE SEDIMENTS AND WATER,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
For primary bibliographic entry see Field 2L.
W81-06263

BACKGROUND HYDROCARBON RESIDUES IN FISHES FROM THE GREAT LAKES AND EASTERN MONTANA,
Johnson (S.C.) and Son, Inc., Racine, WI.
For primary bibliographic entry see Field 5A.
W81-06277

CURRENT PROBLEMS OF SURFACE WATER QUALITY STANDARDIZATION,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 5G.
W81-06287

SIMULATION MODELING OF THE PLANKTON ECOSYSTEM OF A RESERVOIR,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 2H.
W81-06288

EFFECT OF ANTHROPOGENIC FACTORS ON PHYTOPLANKTON AND WATER QUALITY OF THE ANGARA,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 2H.
W81-06294

ECOLOGICAL INDICATION OF WATER QUALITY IN LARGE OLIGOTROPHIC LAKES SUBJECTED TO ANTHROPOGENIC INFLUENCES,
Krasnodar Fisheries Research Inst. (USSR).
For primary bibliographic entry see Field 2H.
W81-06295

MYCORRHIZAL OCCURRENCE IN WILLOWS IN A NORTHERN FRESHWATER WETLAND,
Michigan Univ., Ann Arbor. School of Natural Resources.
P. E. Marshall, and N. Pattullo.
Plant and Soil, Vol 59, No 3, p 465-471, 1981. 3 Fig, 1 Tab, 21 Ref.

Descriptors: *Phosphorus, *Willow trees, *Fungi, Flooding, *Michigan, Peat, Wastewater disposal, Wetlands, Nutrients, Water pollution effects, Effluents.

The intensity of mycorrhizal infection in wetland willows growing in central Michigan was not affected by added phosphorus. Two sites were compared, one water-saturated and one drier. P was added at two levels, 20 or 200 kg P per ha, to simulate potential inputs from the disposal of secondary municipal wastewater effluent. Scoring was based on a 0 to 4 scale, 2 and 3 designating the presence of a definite faunal mantle observed by electron microscopy, with 3 having considerable intercellular hyphae and slight epidermal cell elongation. In the wet site, mycorrhizal infection was rated between 1.86 and 3.30, reaching a minimum in August, a dry month, and a maximum in September. No statistical differences were seen between control, high P, and low P, except in August when the infection was greater than control in the sites receiving P. In the drier site, infection was rated between 1.25 and 3.30, reaching a minimum in August at all sites and a maximum in September at the control site, and a maximum in July in the low and high sites. Low and high P sites had more infection than the controls in July and August, and less in September. (Cassar-FRC)
W81-06318

MERCURY ACCUMULATION IN FISH AND INVERTEBRATES OF THE NORTH FORK HOLSTON RIVER, VIRGINIA AND TENNESSEE,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W81-06326

BACTERIOLOGICAL WATER QUALITY EFFECTS OF HYDRAULICALLY DREDGING CONTAMINATED UPPER MISSISSIPPI RIVER BOTTOM SEDIMENT,
Wisconsin Univ.-La Crosse. River Studies Center.
D. J. Grimes.
Applied and Environmental Microbiology, Vol 39, No 4, p 782-789, April, 1980. 2 Fig, 2 Tab, 39 Ref.

Descriptors: *Dredging, *Bottom sediments, *Water pollution sources, Water quality, *Bacteria, Coliforms, Turbidity, Sewage bacteria, Wastewater, *Mississippi River, Path of pollutants.

The bacteriological effects of hydraulically dredging bottom sediment known to be contaminated with sewage effluent were investigated in the navigation channel of the upper Mississippi River. Bottom sediments at the dredging site contained coliform densities of about 6800/g dry weight, and fecal coliforms comprised an average of 32% of each total coliform count. In samples taken immediately below the dredging site, total coliform and fecal coliform densities were about four times what

they were upstream of the site. Fecal streptococcus densities were about 50 times greater than upstream values. Mean turbidity values downstream to the dredging operation were directly and significantly related to corresponding total coliform, fecal coliform, and fecal streptococcus densities using correlation analysis. Within less than 2 km below the dredge spoil area, the river recovered from the effects of dredging. (Small-FRC)
W81-06331

MERCURY IN TROPICAL MARINE ORGANISMS FROM NORTH QUEENSLAND,
James Cook Univ. of North Queensland, Townsville (Australia).
G. R. W. Denston, and W. G. Breck.
Marine Pollution Bulletin, Vol 12, No 4, p 116-121, April, 1981. 2 Fig, 3 Tab, 69 Ref.

Descriptors: *Mercury, *Marine animals, *Fungicides, Fish, Rocks, Muscle, Invertebrates, Australia, Coastal waters.

Total mercury levels were determined in tropical marine organisms from North Queensland's coastal waters. Mercury sources in the area included the weathering of mercuriferous rocks and the use of the mercurial fungicide Aretan by the sugar industry. Fish generally contained the highest mercury levels, with 50% of the sharks examined having muscle concentrations above 0.5 micrograms/g wet weight. A significant positive correlation was found between shark length and muscle mercury levels. In the teleosts examined, 70% contained less than 0.2 micrograms/g of mercury in the muscle tissue, and 7% contained above 0.5 micrograms/g. In teleosts, mercury levels in the liver were positively correlated with muscle levels. None of the invertebrates examined contained levels higher than 0.5 micrograms/g. Cephalopod molluscs contained the highest levels. Dugong had extremely low mercury levels. The area contained mercury levels slightly above those considered normal for a non-contaminated marine environment. (Small-FRC)
W81-06356

REDUCTION OF MERCURY POLLUTION IN THE VICINITY OF A CAUSTIC SODA PLANT IN THAILAND,
Helsinki Univ. (Finland). Dept. of Environmental Science.
S. Suckcharoen, and M. Lodenius.
Water, Air, and Soil Pollution, Vol 13, No 2, p 221-227, June, 1980. 1 Fig, 3 Tab, 34 Ref.

Descriptors: *Mercury, *Fish, Foods, Food chains, *Thailand, Heavy metals, *Ecological effects, *Industrial wastes, Muds, Plants, Birds.

Fifty-four commercial fish were caught from three areas: a channel lying in front of the TACSCO factory along Suksawad Road at Samut Prakarn Province in Thailand, from a marshland behind the Kobe Battery Mill, and from the canal system near the Dah Yang Chemical Company, also in Samut Prakarn Province. Mud samples were collected from the same localities. Nineteen specimens of piscivorous birds were also taken. Fish samples from the TACSCO area showed a mercury content ranging from 0.10 to 1.38 ppm, while those of the control areas contained 0.01 to 0.30 ppm. Wastewater treatment constituted by TACSCO has brought this level down from previous years. Mercury content of mud samples increased positively in relation to the distance from the factory. Mud samples from the TACSCO area had mercury contents 280 to 1932 times greater than control areas. Bird samples had mercury contents of 0.04 to 0.44 ppm in their muscles and 0.05-1.32 ppm in their livers. The present study indicated that mercury in the fish decreased sharply after the building of a wastewater treatment system. This decrease, plus the localized pocket of mercury pollution, indicated that mercury is easily sedimented or excreted from the aquatic birds. Even so, the fish of this area still have mercury levels above tolerance limits accepted in other countries. Some edible aquatic and terrestrial plants near the factory are also loaded with mercury. Thus local inhabitants may be receiving mercury-contaminated food from several sources. (Baker-FRC)
W81-06358

MONITORING THE TREATED EFFLUENT AND RECEIVING WATERS OF PULP AND PAPER MILLS,
Weyerhaeuser Co., Tacoma, WA. Environmental Technology Dept.
For primary bibliographic entry see Field 5D.
W81-06366

CARBON DIOXIDE TOXICITY IN OXYGEN-ACTIVATED SECONDARY TREATMENT EFFLUENT,
Nekoosa Papers, Inc., Port Edwards, WI.
For primary bibliographic entry see Field 5D.
W81-06368

RELATIONSHIP BETWEEN CONCENTRATION OF HEAVY METALS IN MUSCLE TISSUE AND BODY WEIGHT OF FISH FROM THE SWAN-AVON ESUTARY, WESTERN AUSTRALIA,
Murdoch Univ. (Western Australia). School of Environmental and Life Sciences.
P. J. Marks, D. Plaskett, I. C. Potter, and J. S. Bradley.
Australian Journal of Marine and Freshwater Research, Vol 31, No 6, p 783-793, December, 1980. 2 Fig, 4 Tab, 24 Ref.

Descriptors: *Estuarine environment, *Heavy metals, Environment, Estuaries, Coasts, Iron, Muscle, Zinc, Copper, Manganese, Cadmium, Lead, Chromium, Cobalt, Nickel, Fish, Chemical wastes, Chemical analysis, Growth, Water pollution effects, Swan-Avon estuary, Australia.

Samples were collected from the extensive estuarine regions of the Swan-Avon river system to investigate the relationship between the concentration of heavy metals in fish muscle tissue and the total body weight of the animal. The five species examined included the sea mullet, yellow-eye mullet, yellow-tailed trumpeter, black bream, and Perth herring. Collections were made between February 1978 and April 1979. The concentration of heavy metals in muscle tissue of the teleosts sometimes showed a distinct curvilinear relationship with body weight, with the highest values being present in the smallest fish. In linear regressions, the highest coefficients of determination for any of the nine metals in the five species were 0.25 and 0.23, recorded for zinc in the yellow-tailed trumpeter and yellow-eye mullet respectively. The data on the coefficients of determination and the slopes of the regression equations show that in each species the degree to which heavy metal concentrations tended to decline with body weight was usually greater for iron, zinc, copper and manganese than for cadmium, lead, chromium, cobalt, and nickel, and that in the first group of metals, the pattern of change was generally curvilinear. The mean concentrations of all nine heavy metals in individuals heavier than 50 g were very low in every species, and are probably close to the minimum levels found in these fish in unpolluted environments. The concentration of heavy metals was greater in fish which ingested bottom material than in those which fed on organisms such as polychaetes, molluscs and crustaceans, and on various forms of plants. (Baker-FRC)
W81-06390

EUTROPHICATION STUDY OF LAKE DAYLESFORD, VICTORIA,
Victoria State Rivers and Water Supply Commission, Armadale (Australia).
For primary bibliographic entry see Field 2H.
W81-06391

THE ECOLOGY OF A SMALL CHALK STREAM AND ITS RESPONSES TO DRYING DURING DROUGHT CONDITIONS,
Freshwater Biological Association, Wareham (England). River Lab.
For primary bibliographic entry see Field 2E.
W81-06395

5D. Waste Treatment Processes

EFFECTS OF COAL FLY-ASH DISPOSAL ON WATER QUALITY IN AND AROUND THE INDIANA DUNES NATIONAL LAKESHORE, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
M. A. Hardy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-225021, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-16, April, 1981. 64 p, 11 Fig, 12 Tab, 53 Ref.

Descriptors: *Water quality, *Fly ash, *Settling basins, *Water pollution sources, Ponds, Seepage, Groundwater, Surface water, Alkaline earth metals, Electric powerplants, Trace elements, Radioactivity, Data collections, Chemical analysis, *Indiana, Indiana Dunes National Lakeshore, Great Lakes region.

Dissolved constituents in seepage from fly-ash settling ponds bordering part of the Indiana Dunes National Lakeshore (the Lakeshore) have increased the concentrations of major ions (calcium, fluoride, potassium, and sulfate), trace elements (aluminum, arsenic, boron, iron, manganese, molybdenum, nickel, strontium, and zinc), and gross alpha and beta radioactivities in ground water and surface water downgradient from the settling ponds. Data collected from September 1976 through May 1978 suggest that concentrations of some dissolved trace elements may be greater beneath interdunal pond 2 than in the pond. The soil system downgradient from the settling ponds seems to have affected the concentrations of dissolved ions in the settling-pond seepage. Calcium concentrations were greater in ground water downgradient from the settling ponds than in the ponds. Where organic material was present beneath the settling ponds, concentrations of arsenic, fluoride, molybdenum, potassium, sulfate, and strontium were greater in ground water downgradient from the settling ponds than in the ponds. In contrast, the concentrations of cadmium, copper, nickel, aluminum, cobalt, lead, and zinc were smaller. Leachate from an ash fill bordering the Lakeshore increased concentrations of boron, molybdenum, and potassium in surface water. (USGS)
W81-06088

WASTE-ASSIMILATION CAPACITY OF THE ARKANSAS RIVER IN PUEBLO COUNTY, COLORADO, AS IT RELATES TO WATER-QUALITY GUIDELINES AND STREAM CLASSIFICATION,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-06093

TREATMENT OF BIOLOGICALLY-DEGRADABLE WASTE,
Imperial Chemical Industries Ltd., London (England). (Assignee).
F. C. Roesler.
U.S. Patent No 4,230,563, 6 p, 7 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1537, October 28, 1980.

Descriptors: *Patents, *Wastewater treatment, *Sewage treatment, *Separation techniques, Oxygenation, Biodegradation, Equipment.

A method for treating sewage is described. Sewage is circulated around a system comprising a downcomer and a riser communicating with each other at their upper and lower ends, the downcomer having an upper portion of enlarged cross-section and the riser having a lower portion of enlarged cross-section. Air is supplied to the riser to start the solids-liquid sewage mixture circulating around the system and an oxygen-containing gas is supplied to the sewage as it passes through the lower portion of the downcomer. (Sinha-OEIS)
W81-06137

METHOD FOR PURIFYING PHOSPHATE CONTAINING WASTE WATERS,
Kernforschungszentrum Karlsruhe, G.m.b.H. (Germany, F.R.). (Assignee).
D. Donnert, and S. Eberle.
U.S. Patent No 4,230,565, 4 p, 5 Tab, 7 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1538, October 28, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, Separation techniques, Chemical wastes, Adsorption, Phosphates, Equipment, Aluminum oxide.

A process is described for purifying phosphate containing waste waters in which aluminum oxide is used as the sorption material. The waste water is brought into contact with fine-grained aluminum oxide in a grain size range from 0.05 to 0.2 mm. Simultaneously, a gas is blown in, which is inert with respect to Al_2O_3, and with respect to phosphate ions. Preferably the inert gas is air. The process can also be used successfully with nitrogen, or carbon dioxide, or oxygen as the inert gas. By blowing in air or other gases, an additional purification effect occurs. Moreover, the aluminum oxide sorption agent can be charged higher. (Sinha-OEIS)
W81-06138

TREATMENT OF HAZARDOUS WASTE,
Stablex A.G. (Switzerland). (Assignee).
C. L. Chappell.
U.S. Patent No 4,230,568, 4 p, 4 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1538, October 28, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, *Industrial wastes, Organic wastes, Hazards, Cements, Fly ash, Activated carbon.

A method of treating a liquid hazardous waste which may contain a significant proportion of an organic contaminant comprises the steps of adding to the liquid waste calcium-containing cement and an aluminum silicate or an alumino-silicate (fly ash) thereby forming a flowable slurry. The slurry is allowed to set into a rigid rock-like mass after an amount of active carbon is added to the slurry to reduce the leaching of the waste from the rock-like mass to an acceptable level. (Sinha-OEIS)
W81-06140

SEWAGE EFFLUENT VOLUME CONTROL AND ALARM ARRANGEMENT FOR PRESSURIZED SEWAGE DISPOSAL SYSTEM,
Jet, Inc., Cleveland, OH. (Assignee).
R. E. Culp, and R. G. Baker.
U.S. Patent No 4,230,578, 9 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1541-1542, October 28, 1980.

Descriptors: *Patents, *Wastewater treatment, *Sewage treatment, *Control systems, Automatic control, Septic tanks, Soil disposal fields, Equipment.

Sewage effluent from a septic tank collects in a holding tank before being pumped out into a disposal field. The pump is turned on and off automatically by a control circuit which includes maximum and minimum level float switches in the holding tank, so that a predetermined volume of the effluent is discharged under pressure into the disposal field during each on-and-off cycle of the pump. A third float switch in the holding tank triggers an alarm whenever the effluent rises above a predetermined maximum level. The alarm signalling system may be silenced or tested by a manual switch. (Sinha-OEIS)
W81-06143

METHOD FOR THE PRESERVATION OF AN ACTIVATED SLUDGE,
Sulzer Bros. Ltd., Winterthur (Switzerland). (Assignee).
R. Mona, and J. Gnieser.
U.S. Patent No 4,231,862, 5 p, 1 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 1, p 260, November 4, 1980.

Descriptors: *Patents, *Wastewater treatment, *Biological treatment, *Activated sludge, Preservation, Aerobic conditions, Carbon dioxide, Metabolism.

A method is described for the preservation of activated sludge of a waste water purification stage, where the preservation of such activated sludge is accomplished by flushing with a gas mixture containing at least carbon dioxide and a low oxygen content. It is assumed that in the activated sludge there are present as microorganisms so-called permissive aerobes which are capable of living both with as well as without oxygen. With an adequate oxygen partial pressure these organisms breathe like all other aerobic organisms, and there is formed as an end product of metabolism essentially carbon dioxide. With decreasing oxygen availability and the presence of carbon dioxide, an increasingly greater number of such organisms successively change their metabolism to so-called fermentation processes, and the carbon dioxide concentration in the water surrounding the microorganisms markedly influences the nature of the then occurring fermentation process. This effect can be considered as a slowing down of the metabolism processes, which then gradually leads to a preservation of the original states, so that then there can be extensively prevented losses in biological mass due to self-respiration, as such arise during the sludge stabilization upon aeration. These changes in metabolism are reversible, i.e., these organisms again begin to breathe upon renewed offer of oxygen. (Sinha-OEIS)
W81-06144

METHOD AND APPARATUS FOR TREATING WATER,
E. M. Sutphin.
U.S. Patent No 4,231,863, 9 p, 6 Fig, 2 Tab, 17 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 1, p 260, November 4, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, *Water purification, Aerobic conditions, *Oxygen, Adsorption, Biological treatment, Activated sludge.

A method and apparatus for purifying water or treating waste water utilizes a gaseous medium, and particularly oxygen or air, to lift the water through a biological reactor. The reactor has a plurality of substantially vertical conduit members positioned over a manifold member through which the gas is supplied to the conduit. Preferably, when pure oxygen is employed, the system is sealed and utilizes a carbon dioxide absorber. Optionally, particles may be included in the water being treated. (Sinha-OEIS)
W81-06145

GYRATORY AEROBIC AERATION TREATMENT TANK,
R. W. Heiligtag.
U.S. Patent No 4,231,874, 6 p, 5 Fig, 19 Ref; Official Gazette of the United States Patent Office, Vol 1000, No 1, p 263, November 4, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, *Aeration, *Equipment, Flow systems, Water purification, Aerobic conditions.

A waste treatment tank includes a cylindrical outer shell and a concentric baffle positioned radially inboard of the shell. The annular area between the shell and the baffle delimits an aeration tank section, while the area surrounded by the baffle delimits a clarification tank section. The clarification tank section has an inlet connecting with the aeration section. At least one opening exists along the bottom of the baffle separating the sections for the return of solid matter inadvertently entering the clarification tank section. A submersible pump generates a horizontal circulatory flow pattern in the aeration section, and has a section functioning as a venturi area. A skimmer and an air supply means are operatively connected to the portion along the venturi area. The skimmer extends between the clarification tank and the pump and functions to provide a return from the clarification tank to the aeration tank for floating solid waste. The air supply tubes are connected to an air source and include means for adjusting the amount of air entering the supply tubes so that the aeration process may be regulated. (Sinha-OEIS)
W81-06148

WASTEWATER SPRAY IRRIGATION AT ARMY INSTALLATIONS,
Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD.
J. W. Bauer.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE3, p 435-453, June, 1981. 7 Tab, 15 Ref.

Descriptors: *Spray irrigation, *Land disposal, *Legal aspects, *Wastewater disposal, Wastewater pretreatment, Secondary treatment, Wastewater treatment, Performance evaluation, Regulation, *Impaired water use.

A brief description is presented of the environmental setting, wastewater pretreatment, and model of operation of each of the existing army land treatment systems. Overall performance and level of compliance are discussed. There are five existing domestic wastewater spray irrigation systems, three at golf courses and two on unused grasslands. None of these exceeds an application rate of 1.5 in. per week except for one which receives 2.0 to 3.5 in. per week. All use secondary treatment and disinfection prior to spraying. In order to comply with various state and federal regulations, routine monitoring of effluent and groundwater will be implemented at all sites. At Fitzsimons Army Medical Center corrective measures were taken to eliminate direct spray onto sidewalks and windblown spray onto water fountains. At Camp Oliver, four sprinklers were eliminated because the land was saturated. Fort Hunter Liggett was reduced to 35% of design application rate because of electrical and drainage problems. Overall performance has been good, and all systems are currently in compliance with state and federal regulations and guidelines. (Small-FRC)
W81-06151

PREDICTING FLUIDIZATION AND EXPANSION OF FILTER MEDIA,
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. L. Cleasby, and K-S. Fan.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol, 107, No EE3, p 455-471, June, 1981. 5 Fig, 3 Tab, 8 Ref.

Descriptors: *Filter media, *Fluidized bed processes, *Mathematical models, *Water treatment, Wastewater treatment, Particle shape, Particle size, Backwash, Velocity.

Models for predicting the minimum fluidized velocity of granular materials are modified to include a measure of angularity. Also, a simple method of measuring angularity is presented. Two measures of angularity were made for several filter materials. Sphericity ranged from 0.32 to 0.81, and the dynamic shape factor ranged from 0.20 to 0.70 for the various materials. These measures, when incorporated into the new model, predicted expansion of the uniformly sized filter media with a mean prediction error of 0.06 of the actual ratio of expanded bed depth over initial bed depth when this ratio ranges from 1.1 to 2.0. When full bed fluidization is required, the minimum backwash rate can be calculated from the Wen and Yu equation using the sieve size for the media and adding a 30% safety factor to ensure free movement of the coarser grains in the bed. The Wen and Yu model is inadequate to predict the minimum fluidization. (Small-FRC)
W81-06152

A SITE-SPECIFIC DESIGN OF CHLORINATION FACILITIES,
Vail (Raymond) and Associates, Sacramento, CA.
M. G. Thalhamer.

Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE3, p 473-480, June, 1981. 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Water treatment facilities, *Chlorination, *Design criteria, Pipelines, Pipes, Flushing, Suspended solids, California, *Wastewater treatment.

The design parameters of a successful chlorination facility are defined, and the design of the City of Woodland Wastewater Treatment Facilities (California) is presented. A chlorination facility provides for the addition of chlorine, mixing of the chlorine, achievement of detention time and plug flow, and removal of residual solids. At the Woodland facility a piggyback pipeline design is used which can flush the system of solids without being bypassed or shutdown. A flushing pipe is placed directly under and parallel to the main pipe with vertical tubes connecting the two pipes. The pipe is flushed once every other morning, and a flush takes about eight minutes. The piggyback system removes 20% of the suspended matter. This chlorination facility has operated successfully since March, 1980. Suspended matter of the plant's effluent will be reduced below 30 mg/liter upon completion of a future second phase construction project. (Small-FRC)
W81-06153

AUTOMATION OF WASTEWATER TREATMENT FACILITIES,
Emschergenossenschaft, Essen (Germany, F.R.).
G. Annen.
Water Science and Technology, Vol 13, No 3, p 93-98, 1981.

Descriptors: *Automation, *Control systems, *Wastewater treatment facilities, Emscher River, Flow control, Aeration, Computers, Monitoring, West Germany, *Germany, Emscher Mouth treatment plant.

The automatic control system of the Emscher Mouth wastewater treatment plant (flow rate 20.0 cu meters per sec) in West Germany is described. Coal mining, steel and chemical manufacture predominate in this industrial region of 2.5 million people. Automatic control is incorporated into the flow control system, in the aeration process, in monitoring machinery, and in storing and analyzing process data. Automation is partially used in the grit collecting process and in the primary sludge scraping. This system is not involved in direct process control, and the individual control loops may be improved at will. (Cassar-FRC)
W81-06160

OPERATOR TRAINING IS KEY TO OXIDATION DITCH START-UP AND OPERATION,
Christian, Spring, Sielbach & Associates, Billings, MT.
R. L. Sanks, and J. E. Connell.
Journal of the Water Pollution Control Federation, Vol 53, No 4, p 444-450, April, 1981. 3 Fig, 1 Tab, 5 Ref.

Descriptors: *Oxidation ditches, *Maintenance, Operating costs, Ditches, Oxidation, *Wastewater oxidation, Aeration, Training, Colstrip, Montana, Cold weather construction.

The production of high quality effluents from treatment plants is as much dependent on efficient operation as on suitable design. The best operation is secured through close cooperation between the designer and the operator. The O&M (Operations and Maintenance) manual, hands-on-training, cooperative experimentation, monitoring of results, and continued designer advice are all parts of a good program. Engineering contracts should be written to include the cost of such work over a full season of operation. O&M manuals should be written during the design stage and be available for use before start-up; later they should undergo revisions and modifications that reflect the best operation of the plant. This principle was employed in the startup of the oxidation ditch at the Colstrip, Montana wastewater treatment plant, with a design based on a future flow of 0.6 mgd for a population of 4,000. It is usual for wastewater treatment plants to exceed their discharge permit limitations during startup. However, Colstrip's effluent BOD exceeded 30 mg/l in only two out of 122 tests, and the suspended solids exceeded 30 mg/l in only six out of 129 tests. Special problems created by the cold climate were resolved by design and operating adaptations. (Baker-FRC)
W81-06176

FORCES ACTING ON FLOC AND STRENGTH OF FLOC,
Tokyo Univ. (Japan). Dept. of Urban Engineering and Sanitary Engineering.
T. Matsuo, and H. Unno.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE3, p 527-545, June, 1981. 7 Fig, 11 Tab, 22 Ref.

Descriptors: *Flocculation, *Separation techniques, *Shear stress, Chemical coagulation, *Water treatment, Wastewater treatment, Strength, Mathematical studies.

Experiments were carried out to investigate the quantitative evaluation of the strength of flocculated flocs, and formulas were evaluated to evaluate the dynamic forces. The turbulent component of velocity of fluid flow is explicitly incorporated in the fundamental balance of forces. For suspended almost neutrally buoyant particles such as flocculated flocs, surface shear brought about by the difference in deformability is the predominant force which causes floc breakup. The calculation of a value for the inherent strength of flocs is permitted by the assumption of a pseudosurface tension caused by a thin shell-like structure near the floc surface. Also, floc strength of different flocs can be compared using pseudosurface tension. Floc strength analysis indicated that the optimum alum dosage for the strongest floc is smaller than that which produces the minimum residual turbidity. (Small-FRC)
W81-06185

SLUDGE MANAGEMENT SYSTEMS: OPTIMAL PLANNING,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
Y. Hasit, R. Rajagopal, and P. A. Vesilind.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EE3, p 493-509, June, 1981. 3 Fig, 2 Tab, 25 Ref.

Descriptors: *Mathematical models, *Sludge disposal, *Optimization, Economic aspects, Sludge, *Wastewater treatment, Management planning, Costs, Case studies, Comparison studies.

A mixed integer programming model is presented which evaluates numerous alternatives in sludge management for the selection of a minimum cost plan either for a single plant or for a group of plants in a region. It determines the types, sizes, and locations of treatment units and disposal sites which minimize sludge processing, transportation, and disposal costs. Mixed integer programming is the most appropriate optimization technique due to the fixed charges in the concave cost functions, the exclusive character of some decision variables, and the necessity for some variables to take discrete values. Case studies are presented which test and compare different treatment scenarios. A region with seven water and wastewater treatment plants producing four types of sludges, one incinerator, two landfills, and two land application sites was analyzed. Planners can evaluate numerous alternatives for improving their decisions using the model. (Small-FRC)
W81-06186

THE DEFINITION OF SURFACE RATES IN CLARIFIERS - A REVIEW OF CURRENT AND EARLIER PRACTICES,
Paterson Candy International Ltd., London(England). Process Technology Dept.
D. G. Stevenson.
Journal of the Institution of Water Engineers and Scientists, Vol 35, No 2, p 179-185, March, 1981. 10 Fig.

Descriptors: *Clarifiers, *Reviews, Water treatment, *Wastewater treatment, Filtration, Clarification, Flocculation, Settling basins, Sedimentation, Sludge thickening.

A proposal is made, considering the various types of clarifiers used in water treatment, to establish a generally applicable basis on which the effective area of a clarifier can be defined so that the current divergence may be avoided. It is proposed that such a standard should be based on the total area within the walls of the clarifier at the level at which separation occurs when the tank is working at its full design rate and with some reserve for surges. In most designs this area will occur between the base of the decanting troughs and the lowest normal working level above the rim of the sludge concentrators, and also above any hopper or trough sections. In the case of flotation clarifiers the relevant area should be that of the downflowing zone excluding the riser, not the floating sludge area. This will normally occur in a parallel sided section where the blanket has sufficient height to expand by about one meter without change of surface area in case of increased flow. Ancillary zones such as contact tanks, flocculation and mixing zones, and pulse chambers should not normally be included when performing rise rate calculations. Differing conventions should apply to flotation clarification and flotation thickening. (Baker-FRC)
W81-06189

PEAT--AN ADSORBENT/FILTRATION MEDIUM FOR WASTEWATER TREATMENT,
Queen's Univ., Belfast (Northern Ireland). Dept. of Industrial Chemistry.
G. McKay.
Water Services, Vol 84, No 1012, p 357-359, June, 1980. 4 Fig, 2 Tab, 18 Ref.

Descriptors: *Peat, *Adsorbents, *Industrial wastewater, *Wastewater treatment, Filtration, Oil spills, Color removal, Dye industry wastes, Organic compounds, Surfactants, Phosphates, Meat processing industry, Metals, Heavy metals, Textile mill wastes.

Peat was an effective and cheap adsorbent and filtration medium for treatment of various types of industrial wastewaters containing oils, dyes, organic compounds, phosphates, slaughterhouse effluent, textiles, and metals. Although peat's chemical composition varies with location, it generally contains cellulosic compounds, humic acids and fulvic acids. Laboratory and pilot studies showed that peat effectively absorbs oil from water and beach spills. Colors in dye effluent were removed at a fraction of the cost of activated carbon. Since regeneration is not well established, the peat may be burned to produce low pressure steam. Some success was reported in removing organic compounds and surfactants. Several tests showed that peat had a high phosphorus immobilization. Slaughterhouse wastes (proteins, iron, fats, and phosphorus) were removed up to 90% from wastewater with a 0.15 meter deep peat layer. One problem was clogging of the peat filter. The humic acid functional groups, -COOH and -OH, were stabilized with ammonia and the peat used as an ion exchange system for removal of heavy metal ions from polluted streams. Peat was added to textile effluent in the Hussong-Couplan system. Heavy metals at concentrations up to 300 ppm were removed to an effluent concentration of less than 0.2 ppm. COD, BOD, phosphates and suspended solids were reduced to a small fraction of their original concentration. (Cassar-FRC)
W81-06193

FACTORS AFFECTING EFFLUENT VARIABILITY FROM ACTIVATED SLUDGE PROCESSES,
Brown and Caldwell Consulting Engineers, Pasadena, CA.
S. Niku, and E. D. Schroeder.

Journal of the Water Pollution Control Federation, Vol 53, No 5, p 546-559, May, 1981. 13 Tab, 21 Ref.

Descriptors: *Activated sludge, *Effluents, Wastewater treatment, Sludge, Operating policies, Temperature effects, Suspended solids, Wind, Activated sludge process.

The nature and extent of the variability in effluent quality from activated sludge processes were determined. Factors contributing to this variability were identified through statistical analysis of operating data. Improved understanding of these variabilities will be useful in designing and operating plants with decreased effluent quality variability. System performance can be improved, which should result in a significant decrease in pollution loads on receiving waters and in reduced operational costs. Factors which are involved in the variability of effluent quality include influent variables such as flow, influent biochemical oxygen demand, and suspended solids composition; environmental conditions such as wastewater temperature and wind conditions; biological and operational parameters such as mean cell residence time, mixed liquor suspended solids, food to microorganism ratio, return sludge flow, concentration of sludge, and sludge wastage rate; settling characteristics and clarifier design, including sludge volume index and settleable solids; size of plant and type of process; time effects; human factors; and inherent process variability. Improving operational procedures and those parameters relating to the solids separating facilities seem to be the areas in which the most promising alternatives for process control lie. (Baker-FRC)
W81-06234

ENERGY CONSERVATION FOR EXISTING WASTEWATER TREATMENT PLANTS,
Culp/Wesner/Culp, Santa Ana, CA.
B. E. Burris.
Journal of the Water Pollution Control Federation, Vol 53, No 5, p 536-545, May, 1981. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Energy conservation, *Wastewater treatment, Energy sources, Advanced wastewater treatment, Secondary wastewater, Tertiary wastewater treatment, Pumps, Motors, Disinfection.

Various steps in the wastewater treatment take large amounts of energy. Energy is required for wastewater pumping, primary treatment, secondary treatment, Tertiary treatment, disinfection, building heating and cooling, and sludge treatment and disposal. Even in already existing plants there are areas for conservation which should significantly reduce energy demands. Anaerobic digester gas can be recovered and is a valuable energy source. Incinerator waste heat can also be recovered and used. Various methods of electricity pricing are considered. Specific conservation steps may include the use of pumping adjustments during low flow periods, proper pump maintenance and operation, energy-efficient motors and pumps, energy-efficient variable speed drives, proper plant lighting, heating and ventilation, screening and grit removal, sludge pumping, trickling filters, use of rotating biological contactors, diffused aeration systems, studies of the effect of solids retention time on overall energy utilization, the use of intermittent operation of sludge dewatering process, changes in motor types, and the use of capacitors. Use of sludge for fertilizers or soil conditioners can save energy normally used in dewatering and incineration processes as well as reducing the need for manufacturing fertilizers to some degree. Possible use of solar energy should also be considered. (Baker-FRC)
W81-06235

DIGESTED SLUDGE DEWATERING EXPERIENCES AT ORANGE COUNTY, CALIFORNIA,
Orange County Sanitation Districts, CA.
W. N. Clarke, W. Fox, and W. R. Howard.
Journal of the Water Pollution Control Federation, Vol 53, No 5, p 530-535, May, 1981. 10 Fig, 4 Tab, 1 Ref.

Descriptors: *Sludge drying, *Wastewater treatment, Orange County, California, Sludge digestion, Digestion, Biodegradation, Dewatering, Centrifugation, Oxygen demand, Oxygen, Biochemical oxygen demand, *Waste disposal.

Problems, experiences and costs associated with a dewatering operation carried out by the County Sanitation Districts of Orange County, California are reviewed. Mechanical dewatering of sludge has been carried out there over the past 18 years. During this time the treatment has been upgraded. Currently the system collects, treats, and disposes of 8.54 cubic meters/sec or about 195 mgd of combined domestic and industrial wastewater. The average five day BOD is about 300 mg/liter, and suspended solids average about 325 mg/liter. Nearly 25% of the wasteload is carried by a tributary from industry located in Orange County, including food processors, pharmaceutical labs, metal platers and sugar producers. Until the early 1960s digested sludge was air dried on sludge beds at the treatment facilities. In 1963 a centrifuge plant was added to dewater digested bottom sludge. Currently all digested sludge contents are dewatered using centrifuges. Facilities are present for mixing and feeding polymers. Conveyance and storage of sludge following centrifugation has been upgraded. Final handling of the centrifuged sludge solids is done at the composting facility. The facility has a capacity of 344.1 cubic meters and cost about $450,000. After composting the solids are either disposed of in the remaining landfill area or sold to a local fertilizer company for use as a soil amendment. (Baker-FRC)
W81-06236

TOTAL DOMESTIC WASTEWATER COSTS PEGGED AT $22 BILLION A YEAR,
Murphy (Sage) and Associates, Inc., Denver, CO.
For primary bibliographic entry see Field 6B.
W81-06237

A CRITIQUE OF ASSIMILATIVE CAPACITY,
Caulfield Inst. of Tech., Victoria (Australia). Water Studies Centre.
I. C. Campbell.
Journal of the Water Pollution Control Federation, Vol 53, No 5, p 604-607, May, 1981. 20 Ref.

Descriptors: *Assimilative capacity, Waste disposal, Dissolved oxygen, *Wastewater treatment, *Technology, Water quality, Waste discharge, Aeration.

The term 'assimilative capacity' is discussed as it relates to the field of applied water science. This term came into use during the mid-60's and has two major faults. First, it is used by two groups of technologists working in related areas to mean different things. Secondly, in both cases, the term is inappropriate or meaningless. Wastewater engineers and chemists frequently use assimilative capacity to specify the volume of a waste that may be discharged into a receiving water without lowering the ambient dissolved oxygen concentration below a specified level. Other workers use the term more broadly to mean the ability of a receiving water to absorb wastes without exceeding any of a set of chemical or microbiological criteria. It is suggested that use of this term in either of these two contexts be abandoned. Where dissolved oxygen concentrations are the sole object of the investigation, the terms 're-aeration' and 'reaeration capacity' are more explicit and accurate. When a number of chemical or microbiological parameters are being studied, the actual phenomenon being studied is the waste treatment capacity of the stream. (Baker-FRC)
W81-06238

HYDRAULICS OF INTERMITTENT SAND FILTERS LOADED WITH SINGLE-CELL OXIDATION POND EFFLUENT,
Auburn Univ., AL. Dept. of Civil Engineering.
J. M. Morgan, C. L. Huffman, T. Green, and J. F. Judkins, Jr.
Journal of the Water Pollution Control Federation, Vol 53, No 5, p 587-593, May, 1981. 6 Tab, 7 Ref.

Descriptors: *Sand filters, *Oxidation ponds, *Wastewater treatment, Filters, Sand, Oxidation, Mathematical models, Suspended solids, Effluents, Urban areas.

A comprehensive pilot scale investigation of the effects of intermittent sand filtration on single-cell oxidation pond effluent was performed. Special emphasis was given to changes observed in the hydraulic characteristics of the filters during filtration runs and during daily filtration cycles. Eight intermittent sand filters were constructed adjacant to a single-cell 1,100 cubic meter/day municipal oxidation pond located near Auburn, Alabama. The oxidation pond received wastes from several motels and restaurants as well as from a large mobile home park and other residential areas. The study demonstrated that suspended solids removal efficiencies on the order of 30 to 70% are likely if single-cell oxidation pond effluent is applied to intermittent sand filters. The hydraulic performance of intermittent sand filters loaded with single-cell oxidation pond effluent was highly variable and was related to sand size, hydraulic loading rate, weather conditions and suspended solids loadings. It was also concluded that currently available mathematical methods for estimating the length of filter runs are generally inadequate for design purposes. (Baker-FRC)
W81-06240

DYNAMICS OF ACTIVATED SLUDGE IN TERMS OF ORGANIC CARBON,
Sherbrooke Univ. (Quebec). Dept. of General Chemistry.
N. Therien, and S. Perdrieux.
Journal of the Water Pollution Control Federation, Vol 53, No 5, p 576-586, May, 1981. 17 Fig, 6 Tab, 26 Ref.

Descriptors: *Activated sludge, *Dynamics, *Wastewater treatment, Organic carbon, Carbon, Water quality, Suspended solids, Sludge.

A laboratory-scale activated sludge process was constructed using an aerator and a clarification unit. The essential characteristic of this assembly was that the units were separated from each other, although their individual operational functions were coupled through the effect of a sludge recirculation stream connecting the two units. Analysis was made of the soluble organic carbon (SOC) and suspended solid organic carbon (SSOC) concentrations of the several streams connecting this activated sludge process, which was operated under non-steady-state conditions. The sludge age appeared to have a very important effect on the quality of biological treatment. A nonautocatalytic response for biomass, as already reported elsewhere, was noted; this showed that the dynamics of the biological treatment depended less on the growth rate of microorganisms than on other mechanisms such as the storage of the carbon substrate in the cells. The study of the recycling of sludges suggested that the activated sludge process is characterized by a relatively low rate of growth of the microorganisms, especially with very old sludge. Consideration of the activated sludge process as a process aimed at eliminating the maximum quantity of substrate with the minimum amount of microorganisms may make the process easier to understand. The carbon variable appeared to be a particularly powerful tool to use, as much faster and more precise quantification is offered by this method. (Baker-FRC)
W81-06242

THE FORMATION OF SEPARABLE SUSPENSIONS AND THE METHODS OF ITS ASSESSMENT,
Hydroprojekt, Prague (Czechoslovakia).
F. Hereit, S. Mutl, and V. Vagner.
Aqua, No 5, p 95-99, 1980. 5 Fig, 2 Tab, 3 Ref.

Descriptors: *Wastewater treatment, *Suspensions, *Sedimentation, *Separation techniques, Filtration, Coagulation, Chemical coagulation, Mathematical studies, Mathematical models, Aggregates, Aluminum sulfate, Settling velocity, Temperature effects.

Some results of the HYDROPROJEKT PRAGUE research efforts aimed at treating sus-

pensions in waste waters are reviewed. Hydrolyzing ferric and aluminum salts are used most commonly as destabilization agents. The structures of formed aggregates depend upon the mutual rate of adhesive and tangential forces acting upon the particles during aggregation. Various means of segregation, such as coagulation, direct filtration, double-stage filtration and sedimentation and filtration are considered. Some presumptions for deriving mathematical models to describe the formation of aggregates are outlined. During aggregation testing, various categories of particles may be defined according to settling velocity. Mathematical models are also useful in determining the optimal dose of aluminum sulfate to be used and in calculating aggregation efficiency coefficients. The aggregation test gave adequate results when used on samples of water from the Znojmo Water Treatment Plant. Aggregation procedures were greatly influenced by temperature and the aggregation efficiency coefficients of the samples when used for treatment of color in pilot plant tests. (Geiger-FRC)
W81-06255

SUBSTRATE UTILIZATION KINETIC MODEL FOR BIOLOGICAL TREATMENT PROCESSES,
Science and Agricultural Administration, Clay Center, NE. Meat Animal Research Center.
Y. R. Chen, and A. G. Hashimoto.
Biotechnology and Bioengineering, Vol 22, No 10, p 2081-2095, 1980. 7 Fig, 2 Tab, 25 Ref.

Descriptors: *Biological treatment, *Organic wastes, *Wastewater treatment, Model studies, Contois equation, Aerobic treatment, Anaerobic digestion, Barn wastes, Kinetics, Mathematical equations.

The kinetic equation derived from Contois' model proved applicable for aerobic and anaerobic treatments of organic wastes. This equation is: Effluent substrate concentration = R + (1 - R)K/ (UT - 1 + K), where R = refractory coefficient, K = kinetic parameter, U = maximum specific growth rate of microorganisms, and T = hydraulic or solids retention time. This equation, used with data for aerobic digestions of organic substrates and for anaerobic treatment of dairy wastes, showed good agreement between experimental and calculated results. 58.4% of the dairy wastes were not biodegradable. The kinetic parameters and the refractory coefficients were independent of influent organic substrate concentrations. This study agrees with previous reports that effluent quality of biological treatment systems for organic wastes depends on influent organic waste concentration. Although the refractory coefficient remains fairly constant, kinetic parameters vary with temperature. (Cassar-FRC)
W81-06261

MOSQUITO AND FLY PROBLEMS IN DAIRY WASTE-WATER SYSTEMS,
California Univ., Davis.
E. C. Loomis, R. N. Eide, J. R. Caton, and D. A. Merritt.
California Agriculture, Vol 34, No 3, p 37-38, March, 1980. 3 Fig.

Descriptors: *Dairy industry, *Wastewater management, *Mosquitoes, Aquatic insects, Flies, Stabilization ponds, Ponds.

Polluted water from dairy barns is frequently directed into holding ponds, where it may become a rich environment for the production of mosquitoes and filth flies. The wastewater includes cow manure, spilled feed, milk strippings and solids, and cleaning agents. Cow manure mixed with earth and bedding material from loafing corrals may also be discharged into these ponds. The most common mosquito found in the polluted water is Culex pipiens quinquefasciatus, a carrier of encephalitis. Houseflies and stable flies may also be a problem with these polluted holding ponds. In a survey of 13 dairy farms with ponds, 12 had from 8 to 115 days' water storage capacity, all less than the 4-5 months recommended by the University of California. All but 4 had moderate to severe weed growth along their pond edges. Floating roughages were present in 6 of the 11 one- and two-pond daily systems. Solids completely covered the surface of the ponds at two dairies, and odors were extremely strong due to the anaerobic conditions. Pipeline systems were generally better managed than pond systems. Ponds with dense vegetation on the sides had the highest mosquito populations. Pipeline systems that mixed effluent with well water and used it immediately for crop irrigation had no mosquito problems. Wastewater pond and pipeline systems caused only minor fly problems. The use of soil sterilants and herbicides to control vegetation, better management of watersolids ratio, proper pond construction, maintenance of pond embankments to avoid leakage, and the construction of pond borders to facilitate inspection and vehicle service are offered as suggestions for better mosquito control. (Baker-FRC)
W81-06265

EFFECTS OF PESTICIDES ON DECOMPOSITION OF ORGANIC MATTER AND NITRIFICATION IN SEWAGE,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
M. T. Lieberman, and M. Alexander.
Bulletin of Environmental Contamination and Toxicology, Vol 26, No 4, p 554-560, April, 1981. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Nitrification, *Sewage bacteria, *Pesticide toxicity, *Organic wastes, Waste water treatment, Microbial degradation, Insecticides, Degradation, Herbicides, Carbamate pesticides, Municipal wastes, Decomposition, Pesticides, Organic matter.

The toxicity of eight pesticides on nitrification and respiration processes of sewage microorganisms was studied in laboratory tests. Solutions of carbaryl, propoxur, bendiocarb, diazinon, chlorpyrifos, malathion, 2,4-D, and dichlorvos were added to samples of municipal sewage. Assays for pesticide degradability and biochemical oxygen demand and dissolved oxygen measurements were taken for each test bottle. Garbaryl, malathion, diazinon, chlorpyrifos, dichlorvos, bendiocarb and 2,4-D at levels ranging from 0.1 to 100 ppm had little or no effect on microbial oxygen depletion in the degrading organic matter in sewage, while propoxur was toxic even at 10 ppm. Mixed results were obtained on toxicity studies with the pesticides due to the use of different test times and sewage samples. At levels of 14 micrograms/ml, carbaryl was toxic to nitrification, but this effect dissipated after about 200 hours. Since some of the pesticides were observed to be metabolized during the test, it was suggested that their harmful effects in sewage systems might be minimal. (Geiger-FRC)
W81-06279

FORECAST OF THE DEVELOPMENT OF INDUSTRIAL WASTEWATER TREATMENT METHODS (EXEMPLIFIED BY THE ANTIBIOTICS INDUSTRY),
Yu. P. Belichenko, and V. F. Karpukhin.
Water Resources (English Translation), Vol 7, No 2, p 191-198, March/April, 1980. 7 Fig, 16 Ref. Translated from Vodnye Resursy, No 2, p 170-179, March/April, 1980.

Descriptors: *Soviet Union, *Wastewater treatment, *Reviews, Biological treatment, Physicochemical treatment, Industrial wastes, Biochemical oxygen demand, Pharmaceutical wastes, Antibiotics.

Future trends in industrial wastewater treatment methods were investigated by examining the significance of the engineering solutions presented in articles, patents, and unpublished papers. At present, biochemical treatment is the most prevalent method. The antibiotics industry treats 65 million cu m/year of wastewater with biological methods. In the future, combined treatment methods (biochemical and physicochemical) will become more widespread. It is estimated that the volume of wastewaters treated by this method will increase from 15 million cu m in 1950 to 185 million cu m/year. Pure physicochemical methods are expected to increase by 19% in the future. Wastewater formed during the production of antibiotics can have a BOD as high as 1000-2000 mg/liter. Aerobic fermentation in methane tanks is an effective treatment method. The reagent method which uses flocculants is one of the physicochemical methods gaining use. Presently, mechanical defoaming is used to remove the foam which is common in drug company wastes. Chemical methods and radiation will be used more in the future to control foam. Currently most sludge is disposed of on fields, but other methods may become prominent in the future. (Small-FRC)
W81-06289

MICROBIOLOGICAL REMOVAL OF METAL IONS FROM WATER,
Akademiya Nauk Kazakhskoi USSR, Alma-Ata. Inst. of Microbiology and Virology.
A. N. Ilyaletdinov.
Water Resources (English Translation), Vol 7, No 2, p 182-191, March/April, 1980. 1 Fig, 2 Tab, 53 Ref. Translated from Vodnye Resursy, No 2, p 158-169, March/April, 1980.

Descriptors: *Microorganisms, *Aquatic plants, *Metals, *Absorption, Wastewater treatment, Accumulation, Biological treatment, Ponds, Heavy metals, Soviet Union.

The removal of metal ions from water by aquatic plants and microbes is reviewed. In the biological treatment pond of a lead works, sedge and cattail had the greatest absorbing capacity. In another biological treatment pond, plants accumulated 197-311 mg/kg dry plant weight of Cu, 31-95 mg/kg Zn, and 35-58 mg/kg Pb. Algae are known to concentrate metals in their cells, and the toxicity of chromium compounds is known to decrease during the multiplication of scenedesmus quadricauda and Chlorella vulgaris. The products of humification of organic matter are important in precipitation of metals and can be used to remove heavy metal ions from water. One experiment has shown that a decrease in the concentration of organic matter in sludge reduced the sludge's ability to fix copper. Further investigations are needed to establish the significance of oxidation-reduction activity of microorganisms in the migration in nature of variable valence elements, including As, Fe, Mo, and Mn. (Small-FRC)
W81-06296

FACTORS AFFECTING DEWATERABILITY OF PRIMARY SLUDGES,
Institute of Paper Chemistry, Appleton, WI. Div. of Environmental Sciences.
T. W. Joyce, A. A. Webb, and H. S. Dugal.
Tappi, Vol 63, No 3, p 73-75, March, 1980. 7 Tab, 15 Ref.

Descriptors: *Pulp and paper industry, *Sludge dewatering, *Dewatering, *Wastewater treatment, Industrial wastewater, Cellulose, Hemicellulose, Carbohydrates, Primary sludge, Particle size, Filtration, Wood wastes.

A model primary sludge made from southern loblolly pine was used to study the relationship between carbohydrate composition and dewatering characteristics. A new alkaline extraction process using barium hydroxide and sodium hydroxide sequentially removed hemicelluloses from the sludge. Total hemicellulose content, arabinose content, and xylose content showed high correlation (0.91, 0.94, and 0.93) with the centrifugal water retention test, i.e., as these substances were removed, dewatering improved. Mesh size was not statistically significant. Analysis of mill-generated sludges--kraft/newsprint, groundwood/printing paper, and chemimechanical/duplicating paper--showed that the ratio of hemicellulose to cellulose increased as the particle size and dewaterability decreased. These observations may be used to explain differences in dewatering characteristics between mill-generated sludges. For example, groundwood mill sludges, containing a high proportion of hemicellulose to cellulose, are difficult to dewater. Conversely, bleachable-grade kraft

pulp, which has lost much of its hemicellulose, is relatively easy to dewater. (Cassar-FRC)
W81-06363

STARTUP AND OPERATION OF A HIGH-PURITY OXYGEN-ACTIVATED-SLUDGE SECONDARY TREATMENT PLANT,
Thilmany Pulp and Paper Co., Kaukauna, WI.
M. V. Nelson.
Tappi, Vol 63, No 3, p 61-64, March, 1980. 3 Fig, 3 Tab.

Descriptors: *Pulp and paper industry, *Activated sludge process, Industrial wastes, Pulp wastes, *Wastewater treatment, Oxidation process, Lagoons, Aerated lagoons.

The Thilmany Pulp and Paper Company's effluent treatment plant on the Fox River, Wisconsin, started up in May 1977. It consists of a primary clarifier which treats 76,000 cu meters per day prior to discharge into a 3-stage UNOX high purity oxygen activated sludge reactor. The pulp mill sewer, 9500 cu meters per day, is treated in an aerated lagoon before being sent to the UNOX reactor and secondary clarifiers. The resulting effluent (averaging 13 ppm BOD5 and 38 ppm suspended solids) discharges to the Fox River and the sludge is recycled to the reactor. The effluent has not exceeded net monthly discharge limits during the last two years of operation. Producing an effluent of the specified quality required solving a variety of mechanical and biological problems. (Cassar-FRC)
W81-06364

DEWATERING SECONDARY SLUDGE. A PILOT-PLANT STUDY,
Maine Univ. at Orono. Dept. of Chemical Engineering.
J. M. Genco, and J. J. Carbonello.
Tappi, Vol 63, No 6, p 99-102, June, 1980. 6 Fig, 1 Tab, 9 Ref.

Descriptors: *Filtration, *Sludge dewatering, *Dewatering, *Pulp and paper industry, Wastewater treatment, Industrial wastewater, Secondary wastewater treatment, Sludge conditioning, Rotary filters, Diatomaceous earth.

The rotary vacuum precoat filtration method was evaluated as a means of dewatering secondary sludge from a mill producing mechanical pulp (groundwood and TMP) and LWC paper. Major dependent variables studied were solids loading, cake solids, and solids recovery. Independent variables studied most intently were precoat material, knife advance, sludge conditioning, drum submergence, drum speed, and vacuum intensity. The amount of filtrate was greater with greater vacuum intensity and greater drum submergence. Increases in vacuum increased the cake consistency; increases in drum submergence produced a wetter filter cake. Hyflo Super Cel was the best precoat material tested. The best knife advance rate was the lowest commensurate with stable filter operation (0.01 mm per min at 25% submergence and a recycle time of 30-80-10 sec). Filter cake solids varied between 12 and 29%. Drier cakes were produced with higher polymer dosages and use of 25% primary sludge as a sweetener. Optimum conditions for each material being filtered produced clear filtrates at 90-95% efficiency. (Cassar-FRC)
W81-06365

MONITORING THE TREATED EFFLUENT AND RECEIVING WATERS OF PULP AND PAPER MILLS,
Weyerhaeuser Co., Tacoma, WA. Environmental Technology Dept.
R. N. Thut, R. B. Herrmann, and J. N. Fisher.
Tappi, Vol 63, No 8, p 43-46, August, 1980. 2 Tab, 5 Ref.

Descriptors: *Pulp and paper industry, *Effluents, Monitoring, *Toxicity, Industrial wastes, *Wastewater treatment, Fish, Benthic environments, Outfalls.

Monitoring studies were performed on effluent chemistry, plume dispersion, and receiving water body characteristics at 11 pulp and paper facilities. The plume dispersion/dilution studies were essential elements of the study. They were used to design the chemical and biological field surveys and to interpret effluent data. Bioassay studies revealed low toxicity levels in treated pulp mill effluents to fish (rainbow trout, golden shiner and fathead minnow). In general, there was 100% survival in full-strength effluent. Invertebrate and fish communities below the pump mill outfalls were generally not affected by the effluents. The use of dye dispersion studies in concert with effluent chemistry and biochemistry studies permitted data to be gathered and extrapolated to yield a great deal of information. There appeared to be little chance of toxicity problems developing in the tested areas. (Baker-FRC)
W81-06366

IMPROVEMENTS IN AN ACTIVATED SLUDGE SYSTEM,
Champion Papers, Canton, NC.
W. E. Hirt, D. M. Cody, and L. G. Griffin.
Tappi, Vol 63, No 8, p 49-52, August, 1980. 8 Fig, 2 Tab, 14 Ref.

Descriptors: *Activated sludge, *Wastewater treatment, *Effluents, Dissolved oxygen, Nutrients, Biological oxygen demand, Oxygen, Uptake, Industrial wastes, *Pulp and paper industry.

Continuous difficulties have been encountered in a pulp and paper mill located in Canton, North Carolina. The problem revolved around nonsettling filamentous secondary sludge, and began after the mill's second treatment plant was started up in 1970. Various approaches were investigated, with little improvement resulting. Some of these approches included conversion of the plant's contact-stabilization system to a sequential-flow system, and initiating chemical treatment for adequate sludge settling and dewatering. Very high food-to-mass ratios were noted in one aeration chamber, while very low ratios were noted in a second chamber. This resulted in severely depressed levels of dissolved oxygen (DO) in the first chamber. The causal relationship between low DO levels and bulking sludge in the system was confirmed by bench studies. Changes were made in the waste flow pattern, which then approximated a straight activated sludge system and achieved equalized BOD loadings to the two aeration basins. Improvements were subsequently noted not only in F/M ratios but also in DO levels, oxygen uptake rates, floc sizes, and sludge settling. Both nutrient levels and temperature also affected the efficiency of the overall system. (Baker-FRC)
W81-06367

CARBON DIOXIDE TOXICITY IN OXYGEN-ACTIVATED SECONDARY TREATMENT EFFLUENT,
Nekoosa Papers, Inc., Port Edwards, WI.
D. S. Kuenzi, and D. A. Thief.
Tappi, Vol 63, No 8, p 60-62, August, 1980. 4 Tab, 8 Ref.

Descriptors: *Effluents, *Bioassay, Wastewater treatment, Secondary wastewater treatment, Advanced wastewater treatment, *Carbon dioxide, *Toxicity, *Fish, Activated sludge.

Acute bioassay testing of secondary treatment effluents was undertaken at the Nekoosa Papers plant. The company's two main mills in Wisconsin are located three miles apart on the Wisconsin River. Wastewaters from both mills are treated at a single water treatment center that processes an average of 25 million gal. of flow per day. Each mill's wastewater stream receives separate primary treatment consisting of primary clarification and lime addition for pH control. These two effluents are then combined as they flow to two equalization basins with a combined capacity of 48 million gal. Secondary treatment consists of an oxygen-activated sludge process, with about 3.5 hr of aeration, followed by secondary clarification. The concentration of mixed-liquor suspended solids in the oxygen dissolution basins averages about 7400 ppm, while the activated-sludge recycle concentration averages 2.2%. After clarification the treated effluent flows through a foam pond before discharge to the river. Treatment plant efficiencies are consistently greater than a 95% reduction of BOD and 85% reduction of incoming total suspended solids. Bioassay testing with bluegill fry indicated significant toxicity. The free carbon dioxide content of the effluent was 250-400 ppm. Aeration or pH adjustment to decrease carbon dioxide to less than 73 ppm rendered the effluent nontoxic to the fish. It was determined that the toxicity of the original effluent was due solely to the presence of elevated carbon dioxide levels. (Baker-FRC)
W81-06368

EFFECT OF ULTRASOUND ON THE BIOLOGICAL ACTIVITY OF BACTERIA USED IN WASTEWATER TREATMENT,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
L. L. Turai, C. M. Parkinson, S. G. Hornor, and M. J. Mitchell.
Tappi, Vol 63, No 7, p 81-85, July, 1980. 8 Fig, 1 Tab, 23 Ref.

Descriptors: *Biological wastewater treatment, *Ultrasonics, Bacteria, Wastewater treatment, Aeration, Respiration, Oxygen transfer.

The effect of ultrasound was evaluated on bacteria most frequently encountered in wastewater treatment to select those bacteria which are least affected and to compare their rate of oxygen consumption with and without ultrasonic treatment. A total of 10 cultures were isolated from a municipal waste treatment plant, along with 'mixed liquor' from the same plant. These samples were subjected to ultrasonic irradiation for 15 minutes at a frequency of 25 kHz and an acoustic intensity of 2.0 watt/square centimeter. Wide variations were noted in survival rates ranging from a low of 0% survival to a high of 77%. A close correspondence was noted between respiration and survival rates. The respiration of the mixed liquor population was only slightly affected by ultrasonic irradiation. In studying the most resistant of the bacteria, simultaneous aeration and ultrasonic treatment led to a steady increase in respiration rate, thus indicating that the ultrasonically aerated culture was more metabolically active than those which were not irradiated. (Baker-FRC)
W81-06369

CHEMISTRY OF FIBER BUILDING BOARD MILL EFFLUENT BEFORE AND AFTER BIOLOGICAL TREATMENT,
Swedish Forest Products Research Lab., Stockholm.
M. B. Jansson.
Tappi, Vol 63, No 7, p 78-80, July, 1980. 1 Fig, 3 Tab, 17 Ref.

Descriptors: *Effluents, *Biological wastewater treatment, Mills, Biological treatment, *Wastewater treatment, Biological oxygen demand, Trickling filters, Aerated lagoons, Industrial wastes, Fiber board.

Components in a fiber building board wastewater were studied to determine whether they are degraded and which components resist degradation by biological treatment. The total amount of dissolved wood materials in a fiber building board wastewater is mainly determined by the preheating and refining conditions in combination with raw material characteristics, particularly bark content. Biological treatment was carried out on a plastic medium trickling filter and in an aerated lagoon. The wastewater treated originated from a thermomechanical pulping operation using a defibration pressure of 0.7 MPa for 2 min at a pulp yield of about 95%. The raw material was mixed soft and hard woods. BOD reduction on the trickling filter was 70%, and in the aerated lagoon, 82%. COD reductions were 57% and 58%, respectively. Sedimented wastewater had a total solids content of 5.3 g/liter before and 3.5 g/liter after the trickling filter. Total solids in the untreated wastewater consisted of about 25% lignin-type materials, 16% carbohydrates, 8% uronic acids, 4% acetyl groups, and 30% inorganic material, determined as ash. About 50% of the organic material was removed

by biological treatment in the trickling filter. Carbohydrate reduction was 94%. Klason lignin reduction was 38%, and uronic acids reduction was 28%. Biological treatment reduced the methoxyl content of the Klason lignin. (Baker-FRC)
W81-06370

ULTRAFILTRATION FOR REMOVING COLOR FROM BLEACH PLANT EFFLUENT,
Eka A.B., Surte (Sweden).
H. Lundahl, and I. Mansson.
Tappi, Vol 63, No 4, p 97-101, April, 1980. 7 Fig, 3 Tab, 9 Ref.

Descriptors: *Color removal, *Pulp and paper industry, *Ultrafiltration, Kraft mills, Pulp wastes, Industrial wastes, Filtration, Wastewater treatment, Industrial wastewater, Membranes, Effluents.

Effluent from the alkali extraction stage of a conventional kraft pulp mill is effectively decolorized by ultrafiltration with polysulfone membranes. In an effluent containing 140-150 kg color per ton of pulp and 5-6 kg of BOD7 per ton, this process reduces color by 90%, COD by 80%, BOD by 25-50%, and toxicity by 50%. Most of the high molecular weight lignin is removed. At the Iggesunds Bruk, Sweden, plant four series coupled modules, each with an area of 42 sq meters, treat 500 cu meters of effluent each in 24 hours. The equipment consists of a prefilter, a 10 cu meter buffer system to handle flow variations, automatic ultrafiltration modules, and a filtrate system with automatic membrane washing. The treated water contains low molecular weight chlorinated organic compounds, but it is suitable for reuse as wash water. (Cassar-FRC)
W81-06371

HOW OWENS-ILLINOIS EXPANDED EFFLUENT CONTROL CAPACITY USING INTERNAL RATHER THAN EXTERNAL CONTROLS,
Owens-Illinois Plant, Tomahawk, WI.
C. W. Stahr, S. F. Galeano, and J. R. Retzke.
Tappi, Vol 63, No 8, p 39-42, August, 1980. 1 Fig, 4 Tab.

Descriptors: *Pulp and paper industry, *Wastewater treatment, Industrial wastes, Sludge dewatering, Outfall, *Effluents, Water reuse, White water, Pulp wastes.

The use of recirculation or separate discharge of noncontact cooling waters along with extensive reuse of process streams through selective upgrading at the Owens-Illinois Tomahawk, Wisconsin, pulp and paper mill is described. Five basic goals were set in designing the system: using existing end-of-pipe wastewater treatment facilities, providing adequate facilities and operating plans for periodic cleaning of ponds and for ultimate disposal of sludges, ensuring environmentally safe utilization of the landfill site for 50 years, implementing best management practices to conserve hot water and energy and minimize pollution loads to external system for treatment, and planning contigencies able to handle shock loads associated with start-up. Specific adaptations relate to white water upgrading/reuse, white water surge tank, cooling water separation, seal water recirculation, contaminated condensate reuse, additional aeration, dual operating modes, sludge removal/dewatering, solid waste disposal, effluent system performance, thermal outfall performance, and the sludge dewatering pond. (Baker-FRC)
W81-06372

INDUSTRIAL CHEMICALS AND CHEMICAL FEEDSTOCKS FROM WOOD PULPING WASTEWATERS,
Oak Ridge National Lab., TN.
A. L. Compere, and W. L. Griffith.
Tappi, Vol 63, No 2, p 101-104, February, 1980. 3 Fig, 4 Tab, 19 Ref.

Descriptors: *Wood wastes, *Chemical industry, *Fermentation, Organic compounds, *Pulp and paper industry, Carbohydrates, Solvents, Organic solvents, Industrial wastewater, Wastewater treatment, *Secondary productivity.

Wood pulping wastewaters, which contain varying amounts of carbohydrates, are suggested as raw materials for producing industrial chemicals by fermentation. General requirements for fermentation broths are an organic material (starches, sugars, fruit and vegetable pulps), nitrogen, phosphorus, and, in some cases, sulfur, trace elements, and specific nutrients. Feed streams must not contain materials toxic to the microorganisms (high levels of inorganic salts and phenolics) and must have a pH adjustable between three and eight. Packed tower fermentation, notable for its energy savings, has been tried for the production of ethanol and lactic acid, a raw material for acrylic acid production. Other chemicals feasible for fermentation processes are butanol, isopropanol, glycols, acetone, citric acid, succinic acid, and volatile fatty acids. Treating wastewater in this manner would reduce the costs of waste treatment, add valuable chemicals to the U.S. supply, and reduce dependence on imported oil. (Cassar-FRC)
W81-06374

A 'NONPOLLUTING' BLEACH PLANT,
Uddeholm A.B., Skoghall (Sweden).
S. Lindberg, and L-B. Lund.
Tappi, Vol 63, No 3, p 65-67, March, 1980. 2 Fig, 3 Tab, 6 Ref.

Descriptors: *Color removal, *Ion exchange resins, *Pulp and paper industry, Wastewater treatment, Kraft mills, Industrial wastewater, Toxicity, Phenols, Organic compounds.

An ion exchange system is the key component in a kraft bleach plant treatment system installed at Skoghall, Sweden, in 1973. Although color removal was the primary objective of the plant, there are other advantages--removal of foam-producing substances and chlorides; reduction of BOD, COD, toxicity, and energy costs. Chlorinated phenols and guaiacols in E-stage effluent were reduced as follows (all values in micrograms per liter): 2,4- and 2,6-dichlorophenol, 31 in untreated effluent to 0.1 in treated effluent; 2,4,6-trichlorophenol, 120 to 0.5; 2,3,3,6-tetrachlorophenol, 24 to 0.01; pentachlorophenol, 1.4 to 0.3; trichloroguaiacol, 170 to 0.4; and tetrachloroguaiacol, 500 to 1.4. Rainbow trout exposed for seven days to effluents diluted 40 fold with fresh water accumulated the above mentioned chemicals in liver tissue to the following levels (in micrograms per gram of fat): 0-3, treated E-stage effluent; 0-2, treated C-stage effluent; 3-290, untreated E-stage effluent; and 1-13, untreated C-stage effluent. (Cassar-FRC)
W81-06375

SAFETY IN SEWERAGE,
Thames Water Authority, London (England).
For primary bibliographic entry see Field 6E.
W81-06385

5E. Ultimate Disposal Of Wastes

PRELIMINARY HYDROGEOLOGIC INVESTIGATION OF THE MAXEY FLATS RADIOACTIVE WASTE BURIAL SITE, FLEMING COUNTY, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
H. H. Zehner.
Geological Survey Open-File Report 79-1329, 1979. 66 p, 22 Fig, 7 Tab, 19 Ref.

Descriptors: *Geohydrology, *Radioactive waste disposal, *Geologic formations, *Water quality, Water pollution sources, Streamflow, Low flow, Specific conductivity, Aquifer characteristics, Wells, Water level, Chemical analysis, Aquifer testing, Transmissivity, Storage coefficient, Logging(Recording), *Kentucky, Fleming County, Maxey Flats.

Burial trenches at the Maxey Flats radioactive waste burial site, Fleming County, Ky., cover an area of about 0.03 square mile, and are located on a plateau, about 300 to 400 feet above surrounding valleys. Although surface-water characteristics are known, little information is available regarding the ground-water hydrology of the Maxey Flats area. If transport of radionuclides from the burial site were to occur, water would probably be the principal mechanism of transport by natural means. Most base flow in streams around the burial site is from valley alluvium, and from the mantle of regolith, colluvium, and soil partially covering adjacent hills. Very little base flow is due to ground-water flow from bedrock. Most water in springs is from the mantle, rather than from bedrock. Rock units underlying the Maxey Flats area are, in descending order, the Nancy and Farmers Members of the Borden Formation, Sunbury, Bedford, and Ohio Shales, and upper part of the Crab Orchard Formation. These units are mostly shales, except for the Farmers Member, which is mostly sandstone. Total thickness of the rocks is about 320 feet. All radioactive wastes are buried in the Nancy Member. Most ground-water movement in bedrock probably occurs in fractures. The ground-water system at Maxey Flats is probably unconfined, and recharge occurs by (a) infiltration of rainfall into the mantle, and (b) vertical, unsaturated flow from the saturated regolith on hilltops to saturated zones in the Farmers Member and Ohio Shale. Data are insufficient to determine if saturated zones exist in other rock units. The upper part of the Crab Orchard Formation is probably a hydrologic boundary, with little ground-water flow through the formation. (USGS)
W81-06074

HYDRAULIC CHARACTERISTICS OF AN UNDERDRAINED IRRIGATION CIRCLE, MUSKEGON COUNTY WASTE-WATER DISPOSAL SYSTEM, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
M. G. McDonald.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.00. Geological Survey Water-Supply Paper 2081, 1981. 14 p, 9 Fig, 9 Ref.

Descriptors: *Hydraulic conductivity, *Groundwater movement, *Wastewater disposal, *Sprinkler irrigation, Computer models, Groundwater recharge, Aquifer characteristics, Aquitards, Geohydrologic units, Drainage systems, Numerical analysis, Geohydrology, Evaluation, *Michigan, Muskegon County.

Muskegon County, Mich., disposes of waste water by spray irrigating farmland on its waste-disposal site. Buried drains in the highly permeable unconfined aquifer at the site control the level of the water table. Hydraulic conductivity of the aquifer and drain leakance, the reciprocal of resistance to flow into the drains, was determined at a representative irrigation circle while calibrating a model of the ground-water flow system. Hydraulic conductivity is 0.00055 meter per second, in the north zone of the circle, and 0.00039 meter per second in the south zone. Drain leakance is low in both zones: 0.0000029 meter per second in the north and 0.0000095 meter per second in the south. Low drain leakance is responsible for waterlogging when irrigation rates are maintained at design levels. The capacity of the study circle to accept waste water has been reduced by more than 35 percent. (USGS)
W81-06101

SEWAGE SLUDGE VIRAL AND PATHOGENIC AGENTS IN SOIL-PLANT-ANIMAL SYSTEMS,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
G. T. Edds, and J. M. Davidson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-179103, Price codes: A11 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S1-81-026, April, 1981. 3 p.

Descriptors: *Sludge disposal, *Pathogens, *Municipal wastes, *Digested sludge, *Public health, Crop production, Fertilizers, Bacteria, Viruses, Parasites, Heavy metals, Land disposal.

In this study, a multi-disciplinary approach was used to determine the ultimate fate of various toxic elements or pathogens associated with Florida and

Chicago municipal sludges when applied to soil-plant-water systems as an alternative method for the utilization of recycled digested municipal sludges. Determination was made of the physiologic, pathologic, growth, and reproductive responses of cattle, swine, and poultry that were fed sludges, grains, or forages from soils pretreated with urban liquid digested sludges, as well as health effects in mice receiving liver or kidney tissues from steers and swine exposed to such feeds or contaminants. There were minimal differences in growth performance or egg production in cattle, swine, or poultry fed forage or grain from soils pretreated with a variety of urban sewage sludges. Cattle and swine tissues, when fed to mice, resulted in alterations of the normal mineral balance as well as reproductive performance. Tissues from animals intended for human consumption exposed to sarcocyst contaminated sewage sludges may serve as health hazards for animals and humans. Application of urban sludges at 19.8 ton/hectare produced equivalent plant growth stimulation for corn, barley, wheat, and sorghum as commercial fertilizers. Certain bacteria, commonly associated with sludges, dissapear in a few days after soil or plant application. However, certain viruses and parasites were shown to persist. New and improved methods were developed to monitor persistence as well as assay for the presence of drugs or other hazardous materials. The presence of heavy metals, viruses, and animal parasites in sludges, and their transmission into foods intended for humans or animals indicates that more information on rate and frequency of sludge application is necessary before the practice can be generally recommended. (Brambley-SRC)
W81-06131

AEROSOLS GENERATED BY LIQUID SLUDGE APPLICATION TO LAND,
Southwest Research Inst., San Antonio, TX.
H. J. Harding, R. E. Thomas, D. E. Johnson, and C. A. Sorber.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-178857, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S1-81-028, April, 1981. 3 p.

Descriptors: *Land disposal, *Sludge disposal, *Bacteria, *Viruses, *Aerosols, Air pollution, Spraying, Trace metals, Municipal wastes, Heavy metals, Polychlorinated biphenyls, Water pollution sources, Groundwater, Halogenated pesticides.

Land application of human waste is an attractive waste disposal alternative to disposal in surface waters. This study was initiated to provide information on the generation of harmful microbial aerosols near sites practicing land application of liquid municipal sludge. A preliminary screen was conducted at six sites to characterize sludge with regard to bacteria and viruses, trace metals, organochlorine pesticides, and polychlorinated biphenyls (PCB's). Two tank truck application sites and two spray gun application sites were selected for aerosol monitoring. All six sites and all samples contained measurable levels of cadmium, copper, mercury, nickel, lead, and zinc. Molybdenum was detected in only three samples. Chlordane was detected in four samples, and Arochor 1248 was found in two. Microbiological screens of sludge samples from all sites contained four non-enteric bacteria and eight enterobacteria. Generation of microbiological aerosols at sites using tank trucks probably does occur, but results in very low bacterial levels. There was strong evidence for aerosolization of microorganisms at the spray application sites. No human enteric viruses were detected from a pooled air sample. The presence of microbiological organisms in the sludge, as well as toxic metals, pesticides, and PCB's suggests that the composition of the sludge should be well known before land application is accomplished. There is also a potential for harmful effects through soil and groundwater. (Moore-SRC)
W81-06132

TREATMENT OF HAZARDOUS WASTE,
Stablex A.G. (Switzerland). (Assignee).
For primary bibliographic entry see Field 5D.
W81-06140

WASTEWATER SPRAY IRRIGATION AT ARMY INSTALLATIONS,
Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD.
For primary bibliographic entry see Field 5D.
W81-06151

DIGESTED SLUDGE DEWATERING EXPERIENCES AT ORANGE COUNTY, CALIFORNIA,
Orange County Sanitation Districts, CA.
For primary bibliographic entry see Field 5D.
W81-06236

AEROBIC SLUDGE DIGESTION--A SUGGESTED DESIGN PROCEDURE,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
D. S. Mavinic, and D. A. Koers.
Canadian Journal of Civil Engineering, Vol 8, No 1, p 9-15, March, 1981. 6 Fig, 1 Tab, 17 Ref.

Descriptors: *Cold weather construction, *Sludge digestion, *Design criteria, Waste water treatment, Digestion, Aerobic digestion, Oxygen requirements.

An empirical approach to aerobic digester design is illustrated for a cold climate package plant design. This method may lead to a safer and more cost-effective design practice. The design procedure is based on a graphical solution involving several variables, whereby the percentage reduction of volatile solids is plotted against the product of temperature and sludge age. In all, 16 process parameters were studied. The conventional kinetic approach gave sludge ages of 10.7 days at 20 C and 56.4 days at 5C. Sludge ages calculated by the empirical approach in this paper were 11.0 days at 20C and 44.0 days at 5C. The digester volume for winter temperatures is 4 times that required for summer temperatures. An engineer can choose to use the entire volume throughout the year, reducing the sludge volume in warmer weather, or use a compartment design which reduces the digester volume for summer operation. (Cassar-FRC)
W81-06276

EVALUATION OF THE POSSIBILITY OF USING SURFACE WATERS FOR WASTEWATER DISPOSAL,
V. A. Znamenskii.
Water Resources (English Translation), Vol 7, No 3, p 280-291, May-June, 1980. 1 Fig, 3 Tab, 39 Ref. Translated from Vodnye Resursy, No 3, p 169-183, May-June, 1980.

Descriptors: *Water quality control, *Wastewater disposal, *Surface water, Fisheries, Detergents, Metals, Petroleum products, Biological oxygen demand, Suspended solids.

Dilution requirements for disposing of wastewater into surface waters are listed in terms of USSR regulations. Suspended solids (15 mg per liter in entering water) must be diluted by 60 volumes of water, based on a diluent which is absolutely pure; and ultimate BOD (18-20 mg per liter in entering water), by 6-6.7 volumes. To satisfy fishery requirements, petroleum products (1 mg per liter) must be diluted 20 fold; phenols (0.05 mg per liter), 50 fold; and total, considering the summation principle, 70 fold. To meet toxicological standards, wastewater containing soft synthetic detergents (0.3 mg per liter) need not be diluted; hard synthetic detergents (0.25 mg per liter) require 2.5 fold; Cu, Zn, and Ni (0.1, 0.3, and 0.3 mg per liter, respectively) require dilution by 10, 30, and 30 fold, respectively. These total ions, considering summation, require dilution by 83.5 volumes of water. The discharges from an industrial complex are used to calculate a predicted water quality, based on the background concentrations in diluting water, the rate of discharge, etc. (Cassar-FRC)
W81-06304

DECOMPOSITION OF SEWAGE SLUDGE IN DRYING BEDS AND THE POTENTIAL ROLE OF THE EARTHWORM, EISENIA FOETIDA,
State Univ. of New York at Syracuse. Coll. of Environmental Science and Forestry.
M. J. Mitchell, S. G. Hornor, and B. I. Abrams.
Journal of Environmental Quality, Vol 9, No 3, p 373-378, July/September, 1980. 4 Fig, 4 Tab, 40 Ref.

Descriptors: *Sludge, *Decomposition, Decomposing organic matter, Organic matter, Earthworms, Anaerobic conditions, Digestion, Bacteria, Carbon dioxide, Gas chromatography, Methane, Nematodes, Oxygen, Sludge disposal.

A study was made to determine the decomposition rates of sewage sludge in drying beds as indexed by consumption of oxygen and evolution of carbon dioxide and methane, to ascertain whether E. foetida can alter the form and rate of decomposition, and to ascertain the relationship among specific biotic and abiotic components in decomposition. Fluxes of oxygen, methane, and carbon dioxide showed that at one drying bed site aerobic and anaerobic decomposition and photosynthesis occurred concomitantly, due to high moisture. Similar analyses for two separate trials at a wastewater treatment facility found that both total decomposition rate and percentage of anaerobic decomposition decreased with time and were inversely related to sludge moisture content. Oxygen consumption rates ranged from 10 to 80 microliters/gram dry weight. At both facilities tested the aerobic and anaerobic bacteria were abundant, and the dominant bacteria were not enteric. Nematode densities ranged from 7 to 814 individuals/gram dry weight. A computer simulation model regarding the role of macroinvertebrates in decomposition was used to analyze the effects of the earthworm. This oligochaete was introduced into one-half of the samples; it accelerated decomposition and decreased the proportion of anaerobic decomposition if the sludge was below 375% moisture (relative to dry weight) and had undergone 40% anaerobic decomposition. This stimulation was also noted in increased nematode density and elevated Eh. Flooding of drying beds killed the earthworms. (Baker-FRC)
W81-06327

5F. Water Treatment and Quality Alteration

SELF-CLEANING WATER DISTILLER WITH INTERMITTENT OVERFLOW,
K. D. Lemoine, and R. R. Keegan.
U.S. Patent No 4,230,530, 7 p, 5 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1527, October 28, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, *Water purification, *Distillation, Water pollution treatment, Separation techniques, Equipment, Long-tube vertical distillation.

A water distiller, primarily for producing water for human consumption, includes a boiler, a distillation tower extending about two or more feet above the boiler, and a stream conduit exiting from near the top of the tower leading into a helically grooved condensation tube with a water-cooled jacket. The boiler and tower are of uniform cross-section to facilitate cleaning. The water jacket has a water inlet located in the bottom and an exit orifice for preheated input water at the top. A conduit from the orifice leads to an evaporator for volatile impurities on top of the tower, and a conduit for preheated input water leads to the bottommost part of the boiler from the evaporator. An overflow conduit with an intermittent siphon is provided connected to the bottom of the boiler; the highest and lowest points of the siphon serve to automatically regulate the maximum and minimum depths of water in the boiler. (Sinha-OEIS)
W81-06135

OZONE/ULTRAVIOLET WATER PURIFICATION,
R. C. Dadd.
U.S. Patent No 4,230,571, 7 p, 4 Fig, 14 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1539, October 28, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, Oxidation, *Ozone, *Ultraviolet radiation, Oxygen, Disinfection, Bacteria, Equipment.

A method and apparatus for the purification of water with ozone and ultraviolet radiation is described. Oxygen-containing gas, such as air, is directed to flow in a confined path past an ultraviolet radiation source, such as a mercury vapor lamp. The absorption of ultraviolet radiation by oxygen produces ozone which is entrained in the flowing gas. The gas is next mixed with the contaminated water and the mixture of water and ozone is then directed past the same ultraviolet source in a path isolated from the confined path of gas alone. The ozone in the water acts directly to kill bacteria and viruses and to oxidize undesirable compounds in the water. The ultraviolet radiation also acts directly to kill bacteria and viruses in the water. Additionally the ultraviolet radiation acts as a catalyst for the disinfecting and oxidizing action of the ozone, so that water purification occurs much faster than would occur if the ozone were acting alone. (Sinha-OEIS)
W81-06141

PREDICTING FLUIDIZATION AND EXPANSION OF FILTER MEDIA,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W81-06152

INTEGRAL ANALYSIS OF WATER PLANT PERFORMANCE,
Montgomery (James M.) Inc., Pasadena, CA.
B. L. Ramaley, D. F. Lawler, W. C. Wright, and C. R. Melia.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No 3, p 547-562, June, 1981. 5 Fig, 13 Ref.

Descriptors: *Mathematical models, *Water treatment facilities, *Design criteria, Flocculation, Sedimentation, Filtration, Performance evaluation.

A model for integral water treatment plant design was used to characterize interrelationships among flocculation, sedimentation, and filtration units. Also, the sensitivities of selected plant performance criteria to changes in design variables were analyzed. Overall plant performance is highly sensitive to changes in the velocity gradient during flocculation, the detention time in sedimentation, and the media size in filtration. These design parameters also affect filtrate concentration and head loss development. Dense suspensions comprised primarily of inorganic particles are easier to treat than light suspensions containing amorphous precipitates. This comparison is based on equivalent volume concentrations of solids. Higher velocity gradients, longer settling time, and smaller filter media are required by lighter suspensions to produce acceptable finished water. A conceptual integral approach can be used in water treatment plant design. (Small-FRC)
W81-06154

CONQUERING GROUNDWATER CONTAMINATION.
Journal of the American Water Works Association, Vol 73, No 5, p 29, 32, May, 1981.

Descriptors: *Trichloroethylene, *Groundwater pollution, *Activated carbon, Water supply, Well water, Diisopropyl ether, Methylene chloride, Industrial wastes, Waste dumps, Rockaway, New Jersey, Water treatment, Water pollution control.

Contamination of groundwater by the common solvent trichloroethylene occurred in Rockaway Township, New Jersey. Two of the three Rockaway wells showed consistently high levels of TCE: 50 to 100 micrograms/liter and 170 to 220 micrograms/liter. These wells were taken out of service, as the EPA has suggested that no one should drink water containing more than 4.5 micrograms of TCE. Later, the third well was found to be contaminated by diisopropyl ether and methylene chloride. An activated carbon system was installed which included two adsorption tanks. The system reduced the organic pollutants to less than one microgram/liter in all three well waters. The source of the chemicals has not been found. Because these chemicals have been used for generations and because chemicals move slowly in the earth, the problems may have originated 20 or 30 years ago. TCE was cheap and plentiful and was often dumped after its use. It has recently been discovered in water supplies across the country. (Small-FRC)
W81-06157

THE OCCURRENCE AND REDUCTION OF SODIUM IN DRINKING WATER,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. P. Lauch, and T. J. Sorg.
Journal of the American Water Works Association, Vol 73, No 5, p 256-265, May, 1981. 5 Fig, 7 Tab, 34 Ref.

Descriptors: *Drinking water, *Sodium, *Chemical treatment, *Water treatment, Snow management, Sodium chloride, Deicers, Ion exchange, Industrial wastes, Water quality, Sodium removal.

Causes of sodium level increases during treatment of drinking water and ways of reducing levels in drinking water are discussed. Sodium from natural and man-made sources occurs in raw and finished drinking water. The use of sodium chloride as a deicing agent on roads and the presence of industrial salts in industrial and municipal wastes are common sources of excess sodium. During drinking water treatment, the most significant source of sodium is ion exchange softening, while lime-soda ash softening, disinfection, fluoridation, and coagulation can also add sodium. Treatment methods can be modified to reduce sodium input. For example, hydrogen exchange softening could be used rather than sodium exchange softening. Removal of sodium from raw water or treated water is possible using reverse osmosis, distillation, ion exchange, electrodialysis, and blending methods. Sodium is present in most drinking waters at levels ranging from below detection limits to 1900 mg/liter. (Small-FRC)
W81-06158

FORCES ACTING ON FLOC AND STRENGTH OF FLOC,
Tokyo Univ. (Japan). Dept. of Urban Engineering and Sanitary Engineering.
For primary bibliographic entry see Field 5D.
W81-06185

EXPERIENCES WITH CHLORINE DIOXIDE IN SOUTHERN WATER AUTHORITY AND WATER RESEARCH CENTRE,
Southern Water Authority, Worthing (England).
R. W. Brett, and J. W. Ridgeway.
Journal of the Institution of Water Engineers and Scientists, Vol 35, No 2, p 135-142, March, 1981. 2 Fig, 2 Tab, 17 Ref.

Descriptors: *Disinfection, *Water treatment, Chlorine, *Chlorine dioxide, Wastewater treatment facilities, Bacteria, Phenols, Industrial wastes, Great Britain.

Experiences are described in the use of chlorine dioxide by the Southern Water Authority and the Water Research Center, and illustrations are given of its properties by reference to laboratory and field work. Chlorine dioxide was first used in this area in 1968 at Testwood Waterworks, after a discovery was made of an industrial waste tip several kilometers upstream which, in periods of heavy rain, discharged a strongly phenolic leachate into a tributary of the River Test. Subsequent chlorination of the water produced a strong chlorophenolic taste and numerous complaints. When the water was treated with chlorine dioxide, no incident of chlorophenolic taste resulted, even though low levels of phenol were found in the water. Eventually the problem of phenol discharges ceased and a decision was needed as to whether to continue the chlorine dioxide treatments. It was subsequently noted that the treatment was not controlling the bacteria within the supply, and it was decided to abandon temporarily the use of chlorine dioxide and to increase the chlorine residual to 0.4 mg/l free chlorine. Chlorine dioxide was viewed from that time on as a reserve treatment to be used in case phenolic contamination again became a problem. (Baker-FRC)
W81-06188

CONTROL OF STORM-GENERATED POLLUTION USING A SMALL URBAN LAKE,
Missouri Univ.-Rolla.
For primary bibliographic entry see Field 5G.
W81-06239

ECONOMICS OF SLUDGE MANAGEMENT,
Drexel Univ., Philadelphia, PA. Dept. of Engineering.
Y. Hasit, and P. A. Vesilind.
Journal of the Water Pollution Control Federation, Vol 53, No 5, p 560-564, May, 1981. 1 Tab, 21 Ref.

Descriptors: *Sludge, *Cost analysis, Economic aspects, Wastewater treatment, *Sludge management.

Basic design variables are suggested for sludge processes, which should be useful in defining cost functions. A set of consistent and useful cost equations is presented for various sludge treatment processes. The information is intended for preliminary cost comparisons only and not for detailed design applications, as it is inexact in nature. Some costs found in literature are based on local data, whereas others are based on national data. Labor, maintenance, material and operation costs all vary with location. Climate may be especially important in operating costs such as those incurred with open drying beds and anaerobic digesters. The lack of uniformity in accounting and reporting procedures, such as the allowance for legal and engineering fees, cause difficulty in interpretation. Another difficult aspect of sludge economics has been the determination of the basic variables used to express cost functions. Costs vary with the weight of sludge processed or the volume processed, or the capacity of the unit process, given the type of sludge and the moisture content or percent solids of the sludge. Distance transport if needed for the sludge is also a factor in cost studies. (Baker-FRC)
W81-06241

ENERGY SAVING THROUGH THE REDUCTION OF LEAKAGES BY APPLYING AN IMPROVED METHOD OF FLOW CONTROL,
G. F. Heide.
Aqua, No 5, p 101-105, 1980. 8 Fig, 1 Tab.

Descriptors: *Flow measurement, Distribution, Water distribution, Leakage, Monitoring, Hydraulic equipment, Measuring instruments, Control systems, *Flow control, Water supply systems, Maintenance, Leakage control.

An improvement on the measuring of minimum night flow periods of water distribution systems is described which is controlled by regular automatic short duration measurements. The WACO system may be used with existing meters to take measurements from outside of the measuring chambers. An alarm system is included for rapid control of leakage. The short-duration measurements (30 min intervals) achieved will allow an improved overnight leakage control at a small economic investment for most waterworks. This equipment offers remote control recordings which may be checked at hydraulic network control centers. The production of masses of charts is avoided, and information about smaller leaks is received sooner. When the equipment is installed, total leakage is often kept to 1% of the total volume of water consumed per year. Many waterworks have already installed or are planning to obtain measuring units for performing such studies. (Geiger-FRC)
W81-06253

AUTOMATIC RAW WATER QUALITY MONITORING STATIONS AT MORSANG/SEINE

(LA SURVEILLANCE AUTOMATIQUE DE LA QUALITE DE L'EAU BRUTE).
Aqua, No 5, p 9-11, 1980.

Descriptors: *Water quality control, *Bioassays, *Water treatment facilities, Water pollution control, Water quality management, Monitoring, Automation, Turbidity, Dissolved oxygen, Hydrogen ion concentration, Ammonia, *Raw water, Conductivity, Rivers, Water supply.

The Societe Lyonnaise des Eaux et de l'Eclairage has constructed an automatically controlled monitoring system to check the quality of the raw Seine water which enters the Morsang-sur-Seine water treatment plant. A pollution warning station five kilometers upstream from the plant houses trout for a bioassay test to detect the presence of harmful substances in the water. Death of the fish would be detected on a photoelectric system, and a pollution warning alarm would occur if three of four fish died. An automatic analysis unit continuously checks six water quality parameters: turbidity, conductivity, temperature, dissolved oxygen, pH, and ammonia. The equipment developed by the DEGREMONT Company needs very little maintenance. Data from the system are transmitted to the Vigneux-sur-Seine center to be stored on discs for easy access for further statistical processing. (Geiger-FRC)
W81-06254

THE FORMATION OF SEPARABLE SUSPENSIONS AND THE METHODS OF ITS ASSESSMENT,
Hydroprojekt, Prague (Czechoslovakia).
For primary bibliographic entry see Field 5D.
W81-06255

CONTROLLING ORGANIC COMPOUNDS IN WATER--BY TREATMENT,
Water Research Centre, Marlow (England).
T. Burke.
Water, No 34, p 17-19, September, 1980. 3 Fig, 3 Tab.

Descriptors: *Organic compounds, *Water treatment, *Drinking water, Municipal water, Chlorination, Disinfection, Activated carbon, Great Britain, Economic aspects.

The presence of organic compounds, particularly trihalomethanes and synthetic organic compounds, in drinking water and the potential health risks posed by these compounds have caused increasing international concern. The Water Research Centre in Great Britain is investigating methods for controlling trihalomethanes and synthetic organic compounds present in raw water. Elimination of prechlorination processes and reduction of organic levels prior to disinfection are the most effective ways to reduce trihalomethane levels. Disinfection by alternatives to chlorine may also provide a solution to high trihalomethane levels, but currently available alternatives are not free of concern on health grounds. Granular activated carbon adsorption is the best technique currently available for the removal of synthetic organic chemicals. Although activated carbon is extensively used for taste and odor control in water treatment, different design techniques and careful consideration of type of carbon and carbon handling and regeneration requirements are needed to apply this process to removal of significant quantities of synthetic organic compounds on a continuous basis. In addition, selection of wrong process or engineering design criteria can result in substantial wastes of money both in capital and in operating costs. The treatment research program is designed to produce a protocol for selection of the most cost effective system for use by facilities installing measures to control synthetic organic compounds. (Carroll-FRC)
W81-06323

COMPARATIVE INACTIVATION OF VIRUSES BY CHLORINE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
R. S. Engelbrecht, M. J. Weber, and B. L. Salter.
Applied and Environmental Microbiology, Vol 40, No 2, p 249-256, August, 1980. 5 Fig, 4 Tab, 6 Ref.

Descriptors: *Viruses, *Chlorine, Disinfection, Water quality, Wastewater treatment, Picornaviruses, Enteroviruses, Parvoviruses, *Water treatment.

This study examined the effect of virus type, pH, and potassium chloride on the kinetics of virus inactivation by free available chlorine. Experiments were performed with polio 1 and 2, echo 1 and 5, and coxsackie viruses A9 and B5. The inactivation of these six viruses was studied at pH 6 and 10. Chlorine inactivation studies were also performed at pH 7.8 with echo 1 and 5, coxsackie B5, and polio 1 to have data comparable to other studies. There was a significant difference in the time required for 99% inactivation of the various viruses at pH 6 and 10. In every case, the rate of inactivation at pH 10 was dramatically less than at pH 6. Rank ordering of the results indicates the wide range of susceptibilities of related viruses to chlorine disinfection. There were several cases in which the relative susceptibility to chlorine changed between pH 6 and 10 with respect to rank ordering, suggesting an important effect of pH on the virion as well as on the chlorine species. The thought that virus groups other than the enteroviruses might differ greatly with respect to chlorine susceptibility was tested with Kilham rat virus, a parvovirus containing single-stranded deoxyribonucleic acid, and SV40, a double-stranded deoxyribonucleic acid oncogenic virus. Kilham rat virus was no more resistant to chlorine than any of the picornaviruses. SV40 appeared extremely susceptible to chlorine. It is noted that the presence of potassium chloride also affected the susceptibility of viruses to chlorine. (Baker-FRC)
W81-06324

THE ECONOMICS OF CARBON REGENERATION STATE OF THE ART,
Manchester Water Works, NH.
D. Kittredge.
Journal of the New England Water Works Association, Vol 94, No 1, p 1-23, March, 1980. 6 Fig, 3 Tab, 12 Ref.

Descriptors: *Activated carbon, *Regeneration, *Carbon filters, Drinking water, Economic aspects, Costs, Water treatment.

The state of the art methods and costs of carbon regeneration today are reviewed, as post-filtration contactors or deep-bed granulated activated carbon filters are frequently needed to meet EPA drinking water quality regulations. Most systems using GAC treatment will find it more economical to regenerate the carbon once its adsorptive properties are spent. On-site regeneration systems cost from $0.05 to $0.20/lb, while off-site custom regeneration systems cost in the mid $0.30/lb range. Selection of the most economical regeneration method depends on a number of variables and site-specific requirements. For on-site regeneration systems, major considerations include the capital cost of the system, the cost of makeup carbon requirements, the regeneration frequency required, plus the cost of operating labor, energy, and replacement parts. New technologies including fluidbed and infrared type may cost less than traditional carbon regeneration methods. (Small-FRC)
W81-06330

INACTIVATION OF POLIOVIRUS I (BRUNHILDE) SINGLE PARTICLES BY CHLORINE IN WATER,
North Carolina Univ. at Chapel Hill. Dept. of Bacteriology and Immunology.
D. G. Sharp, and J. Leong.
Applied and Environmental Microbiology, Vol 40, No 2, p 381-385, August, 1980. 5 Fig.

Descriptors: *Viruses, *Disinfection, *Chlorine, Chlorination, Water quality, Wastewater treatment, Poliovirus, Sediments, Aggregates, Hydrogen ion concentration.

Chlorine inactivation of poliovirus I (Brunhilde) was investigated. The progress of inactivation of single dispersed preparations of poliovirus by several different concentrations of HOCl at 20 C in dilute phosphate-carbonate buffer at pH 6 was studied. When 0.1 M sodium chloride was added to the dilute phosphate buffer, the inactivation rate was doubled, but it was still not as fast as the inactivation rate of poliovirus (Mahoney) under similar conditions. No transient departures from linearity were noted during the first 20 seconds of contact with the chlorine, either with or without the salt. At pH 10, the rate of reduction in plaque forming units in dilute buffer alone was only about one-fifth as fast as it was at pH 6, but the effect of salt was much greater. The time required to inactivate 99% of the plaque-forming units with 0.1 M sodium chloride was 31 times greater than when the salt was present. Thus disinfection was faster at pH 10 with salt present than it was at pH 6, whether salt was present or not. The possibility that aggregation of the virions might exert an influence on these reaction rates was examined. There was no evidence of aggregation at pH 7-9. At pH 10 there was some loss in plaque titer, but this was due to a loss of infectivity rather than to sedimentation of supernatant plaque-forming units due to virion aggregation. At pH 6 aggregation set in. It was slow when 0.1 M NaCl was present, but in the absence of salt only about 10% of the population remained as single particles after 4 hr at 25 C in the dilute buffer. (Baker-FRC)
W81-06344

EFFECT OF DISINFECTANTS ON PATHOGENIC FREE-LIVING AMOEBAE: IN AXENIC CONDITIONS,
Massey Univ., Palmerston North (New Zealand). Dept. of Microbiology and Genetics.
R. T. M. Cursons, T. J. Brown, and E. A. Keys.
Applied and Environmental Microbiology, Vol 40, No 1, p 62-66, July, 1980. 3 Tab, 24 Ref.

Descriptors: *Disinfection, *Pathogens, Human diseases, Water pollution, Chlorine, Ozone, Deciquam 222, Chlorine dioxide, Recreational facilities, Drinking water, Potable water, Swimming.

The effectiveness of chlorine, chlorine dioxide, ozone, and deciquam 222 (dodecyldimethylammonium bromide) against pathogenic and nonpathogenic species of Naegleria and Acanthamoeba was investigated. The Naegleria spp. were more susceptible to chlorine than Acanthamoeba spp., with 0.79 mg of total available chlorine or initial free available chlorine per liter being amoebicidal for Naegleria spp., as opposed to 1.25 mg of total available chlorine per liter for Acanthamoeba spp. In disinfectants other than chlorine, the Naegleria spp. were once again more sensitive than the other to the chlorine-containing disinfectants, but no marked difference was noted in the sensitivity among the four strains toward ozone or deciquam 222. Of the alternative disinfectants studied, deciquam 222 exhibited the greatest amoebicidal capacity, followed by chlorine dioxide and ozone. The results demonstrate that all four disinfectants examined possess amoebicidal properties and would be suitable for the disinfection of waters contaminated with pathogenic free-living amoebae. However, the choice of a particular disinfectant remains closely tied to the chemical and physical characteristics of the water to be treated and to the particular properties of the disinfectant itself. (Baker-FRC)
W81-06345

EFFECT OF IONIC ENVIRONMENT ON THE INACTIVATION OF POLIOVIRUS IN WATER BY CHLORINE,
North Carolina Univ. at Chapel Hill. Dept. of Bacteriology and Immunology.
D. G. Sharp, D. C. Young, R. Floyd, and J. D. Johnson.
Applied and Environmental Microbiology, Vol 39, No 3, p 530-534, March, 1980. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Disinfection, *Water pollution control, *Chlorine, Viruses, Water pollution, Acidity, Poliovirus.

Results are reported of a series of inactivation experiments with chlorine and poliovirus type 1 at

pH 6, 7, 8, 9, and 10. The virus used was poliovirus type 1 (Mahoney) prepared in cultures of human epidermoid carcinoma (HEp-2). At pH 6, 7, 8, and 9 the concentrations of OCl-present were 0.11, 0.90, 9.1, and 91 microM, respectively. The pH 10 experiments were made at lower chlorine concentrations. There were remarkable increases in the reaction rate between pH 6 and 7 and successively smaller increases at pH 8 and 9, whereas the OCl- concentration steadily increased by about a factor of 10 at each step. It was concluded that the rate of inactivation of poliovirus in water by chlorine was strongly influenced by the pH, which in turn influences the relative amounts of HOCl and OCl- that are present and acting on the virus in the region of pH 6-10. The distribution of HOCl and OCl- was influenced to a lesser extent by the addition of sodium chloride. The major part of the sharp increase in disinfection rate seen with this salt is thought to be due to its effect on the virus itself, resulting in an increased chlorine sensitivity, especially at high pH levels. (Baker-FRC)
W81-06348

POLIOVIRUS CONCENTRATION FROM TAP WATER WITH ELECTROPOSITIVE ADSORBENT FILTERS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
M. D. Sobsey, and J. S. Glass.
Applied and Environmental Microbiology, Vol 40, No 2, p 201-210, August, 1980. 3 Fig, 3 Tab, 33 Ref.

Descriptors: *Drinking water, *Viruses, Water quality, Filtration, Poliovirus, Adsorbents, Filters, *Water treatment, Acidity, Adsorption.

Two electropositive filter types were rigorously evaluated for their applicability to adsorption-elution virus concentration methods. Comparisons were made between poliovirus concentration efficiencies by these less electronegative filters and by a widely used strongly electronegative fiberglass-epoxy filter. Simple, reliable, and efficient concentration of poliovirus from tap water was obtained with two types of electropositive filter media, one of which is available in the form of a pleated cartridge filter, Virozorb 1MDS. Virus adsorption from tap water between pH 3.5 and 7.5 was more efficient with electropositive filters than with Filterite filters. Elution of adsorbed viruses was more efficient with beef extract in glycine, pH 9.5, than with glycine-NaOH, pH 11.0. In paired comparative studies, electropositive filters, with adsorption at pH 7.5 and no added polyvalent cation salts, gave less variable virus concentration efficiencies than did Filterite filters with adsorption at pH 3.5 plus added MgCl2. Recovery of poliovirus from 1,000-liter tap water volumes was about 30% efficient with both Virozorb 1MDS and Filterite pleated cartridge filters, but the former were much simpler to use. The virus adsorption behavior of these filters appeared to be related to their surface charge properties, with more electropositive filters giving more efficient virus adsorption from tap water at higher pH levels. (Baker-FRC)
W81-06349

THE KLADOW MUNICIPAL WATERWORKS IN BERLIN: AN EXAMPLE OF FULL AUTOMATION,
J. Naumann.
Aqua, No 1, p 41-45, 1981. 4 Fig.

Descriptors: *Automation, *Water treatment facilities, *Municipal water, *Berlin, Federal Republic of Germany, Computers, Water storage, Water delivery, Drinking water, *Water supply systems.

The municipal water treatment facility in the Kladow District of West Berlin has installed a process computer with on-line, closed-loop operation. The process computer stores and interprets incoming data from the process and intervenes in the process in open and closed loop modes without the action of operating personnel. The system is designed to achieve process optimization through the determination of desired objective variables and their realization with the minimum possible costs and with maximum protection of the plant from any overloading which might occur. This automated effect should reduce the failures of individual technical units and achieve the highest possible availability of all systems. The process computer supervises, controls, regulates, and optimizes all the individual areas of operation and ensures optimal interaction of the procedures involved. The Kladow water treatment facility can deliver up to 50,000 cubic meters of pure water per day. Tasks performed by the process computer include control, regulation, and optimization of ground water procurement and pure water delivery; control and optimization of pure water processing; and control and regulation of the electrical power input. Individual automation tasks include data acquisition, data processing, process optimization, and data output. An operator's console in the control room of the facility permits monitoring and control of the entire process by operating personnel in the event of a malfunction by the computer. The facility, which previously operated with three shifts, has initiated one-shift operations since installation of the automated system. In addition to labor savings, mean time between failures has been reduced to 360 hours, the mean time to repair is about 7 hours, and the relative availability of the system has been increased to 98.1 percent. (Carroll-FRC)
W81-06362

GLENDYE TREATMENT WORKS,
Crough and Hogg (England).
G. A. Milne, and J. Mellanby.
Journal of the Institution of Water Engineers and Scientists, Vol 35, No 2, p 155-167, March, 1981. 1 Tab, 5 Fig.

Descriptors: *Water treatment facilities, Water treatment, *Scotland, Chemical treatment, Flocculation, Filtration, Design standards, Sludge drying.

This paper describes the Water Treatment Works of the Glendye Water Supply Scheme serving the north Kincardineshire area of Grampian Region, formerly of the North East of Scotland Water Board area. In 1966 the scheme comprised a river intake, a 15 in. diameter concrete-lines, spun iron, raw water pipeline 13.7 km long to the Treatment Works 6.5 km southwest of Banchory and a 4546 cubic meter treated water tank at the treatment works. In 1969 the Works as commissioned consisted of a main plant building, the clear water tank, and two simple sludge ditches. Flow regulation, chemical storage and dosing, filters and their ancillary and control units, chlorine plant and store rooms were located in the main building. The new works include a wash water header tank, a wash water recovery tank, a sludge press building, a structure to house the new flotation plant, considerable piping additions and alterations, and minor works including an access road to the sludge tipping area, a buried glass fiber tank, and drainage modifications to eliminate the risk of chemical spillage reaching a watercourse. Operational experience is described, along with some cost factors. (Baker-FRC)
W81-06381

CURRENT STRATEGIES IN WATER TREATMENT DEVELOPMENTS WORLDWIDE,
Binnie and Partners, London (England).
F. W. Crowley, and A. C. Twort.
Water Services, Vol 84, No 1008, p 95-98, 101-103, February, 1980. 6 Fig.

Descriptors: *Water treatment facilities, *Developing countries, Wastewater facilities, Water treatment, Mineral water, Clarification, Filtration.

In many developing countries water treatment strategy is influenced by the fact that water demand greatly exceeds supplies available. Overseas (from England) treatment strategy reflects two principal characteristics relating to the nature of the water to be treated. First, in tropical and sub-tropical areas where rainfall is plentiful, the main sources of water in large quantities are the rivers, which may have very high suspended solids at times. Secondly, in the developing areas of the Middle East where a desert climate prevails, it is becoming necessary to use desalinated sea water or high temperature underground waters with a high mineral content, with little or no other water available for blending. In England the current philosophy is toward achievement of fringe economies related to the use of closer methods of control and water treatment processes, and finding means of solving pollution problems arising from the use of industrially polluted water sources. Clarification and pretreatment strategy as viewed overseas and in England are considered. Filtration strategy and plans for the use of highly mineralized waters are also discussed. (Baker-FRC)
W81-06384

125 YEARS OF WATER SUPPLY IN BERLIN,
H. Tessendorff.
Aqua, No 1, p 7-11, 1981. 4 Fig.

Descriptors: *History, *Water supply, *Metropolitan water management, *Berlin, Germany, West Berlin, Water quality management, Water supply development, Drinking water.

A short history of municipal water supply development and management in Berlin, Germany, from 1856 to the present is presented. The first water supply plant, which used surface water from the Spree River, was put in operation in 1856 in an effort to improve the disposal of sewage and garbage. The water supply company was required to provide, free of charge, water for flushing the gutters which carried sewage through the city streets. Two new plants put into operation in 1877 were intended to use groundwater, but lack of technology relating to the removal of manganese and iron caused them to switch to surface water resources. Improved technology resulted in reverting those plants to groundwater treatment in 1901. By 1939, there were 13 municipally-owned water treatment plants servicing the city and some surrounding areas. Heavy damages incurred during the Second World War and the subsequent political division of the city resulted in two-thirds of the population of Berlin being served by about one-third of the capacity of the former water supply system. As a result, a rapid and thorough expansion of the waterworks and distribution facilities was implemented. Although the city is situated in an ideal hydro-geological location, with a huge underground reservoir capable of providing a safe, long-term water supply, poor water resources management has resulted in a considerable groundwater deficit accompanied by a drop in ground water level. Artificial groundwater recharge programs are currently being expanded. Management of the Berlin waterworks has been merged with that of the Berlin sewage treatment facilities in an effort to develop closer coordination on problems of water quality and water quantity management. (Carroll-FRC)
W81-06388

5G. Water Quality Control

METHOD FOR DEPOLLUTING FRESH WATER AND SALT WATER BODIES FROM CRUDE OIL, PETROLEUM PRODUCTS AND THEIR DERIVATIVES,
Snamprogetti S.p.A., Milan (Italy). (Assignee).
R. Olivieri, A. Robertiello, and L. Degen.
U.S. Patent No 4,230,562, 4 p, 2 Tab, 12 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1536-1537, October 28, 1980.

Descriptors: *Patents, *Water quality control, *Water pollution treatment, *Oil pollution, Water bodies, Microorganisms, Nutrients, Biodegradation, Micro degradation, Phosphorus, Nitrogen.

A method and a few compositions are disclosed, which are adapted to depollute fresh and sea water bodies from crude oil and petroleum product pollution by microbial action. The growth of microorganisms capable of metabolizing hydrocarbons is exalted by certain combination of nutrients, such as lecithin as a phosphorus source, hydantoins, amides allophanates, polyamines, acyl-ureas and esters of the hydantoic and allantoic acids as the nitrogen sources. Ureido-derivatives of amides are

also contemplated as additional nutrients. (Sinha-OEIS)
W81-06136

FOAMACEOUS HYDROCARBON ADSORPTION MEDIUM AND METHOD AND SYSTEM FOR MAKING SAME,
Petrozorbent Corp., Zanesville, OH. (Assignee).
T. L. Faudree, III.
U.S. Patent No 4,230,566, 10 p, 5 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1538, October 28, 1980.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, *Oil pollution, Industrial water, Adsorption, Chemical reactions, Polymers.

A new, low density, polymeric medium for adsorbing hydrocarbons involuble in water is described. Provided in granular form, the material readily absorbs contaminant hydrocarbons on weight-to-weight bases at the level of about 40:1. Of particular importance, the material is producible under a broad range of ambient temperatures and at competitive costs. The low density granulated polyurethane cellular polymer is produced by pre-reacting a polyisocyanate with a long-chain monohydric alcohol or mixture of long-chain monohydric alcohol of about 8 to 12 carbon atoms inclusive to form a prepolymer. Following the formation of this prepolymer, a polyol is combined with it in the presence of a blowing agent. Before the substantial reaction of this mixture takes place, it is transferred to a mold to permit the exothermic development of a cellular polyurethane. Within a predetermined time from the development of the resultant cellular polyurethane bun, the formation is transferred to a comminution stage whereupon it is reduced to granular size. Formation of the cellular polymer within the mold can take place under a broad range of ambient conditions, inasmuch as the foam becomes self insulative and the reaction is exothermic. Thus, the heat so generated is retained within the bun as it is formed to sustain the reaction. Consequently, a manufacturing system for the materials can be established at convenient locations, for example at the shoreline or on shipboard in the case of producing material to remove an oil spill on the seas. (Sinha-OEIS)
W81-06139

TANK FOR CLEANING AND CHEMICAL TREATMENT OF BOILER FEEDWATER,
E. J. Bennecke, and M. R. Bennecke.
U.S. Patent No 4,230,577, 4 p, 1 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 999, No 4, p 1541, October 28, 1980.

Descriptors: *Patents, *Water quality control, *Industrial water, Boiler feedwater, Scaling, Corrosion, Chemical reactions, Equipment, Flow systems, *Boiler water.

A boiler feedwater conditioning tank removes mud, iron and any other settleable solids from boiler feedwater and adds soluble chemicals. The feedwater is mixed and heated by passing the mixture down and around and up into and through a system of concentric open-ended standpipes erected within the tank. The outlet for clean feedwater lies at the top of the tank inside the upper end of the inner standpipe. The input port for chemicals lies in the tank side walls and steam heating coils lie between the outer standpipe and the wall of the tank in the path of convective flow of feedwater. (Sinha-OEIS)
W81-06142

CONTROL OF STORM-GENERATED POLLUTION USING A SMALL URBAN LAKE,
Missouri Univ.-Rolla.
L. J. Oliver, and S. G. Grigoropoulos.
Journal of the Water Pollution Control Federation, Vol 53, No 5, p 594-603, May, 1981. 6 Fig, 5 Tab, 14 Ref.

Descriptors: *Storm runoff, *Water quality control, *Lakes, Nitrogen, Oxygen demand, Phosphorus, Suspended solids, Sedimentation, Bacteria, Algae, Frisco Lake, *Detention reservoirs.

Research was conducted on the control of storm-generated pollution in a small urban area, involving the detention and natural treatment of runoff by a small recreational lake. Quality and quantity of inflow and outflow of a 2.3-ha lake draining a 45-ha area were monitored over a six month period. Results were evaluated to establish the short- and long-range benefits of the lake as a source control measure for abating storm-generated pollution. The quality of stormwater runoff was significantly improved after passing through the lake. On the average basis over the study period, organic nitrogen, chemical oxygen demand, total phosphorus and total suspended solids decreased by 31, 52, 65, and 89%, respectively, and NH3-nitrogen increased by 13%. The quantity of runoff pollutants was significantly reduced in the lake. On the average basis during the 7.3-day storm cycle, organic nitrogen, chemical oxygen demand, total phosphorus, and total suspended solids decreased by 22, 54, 65, and 88%, respectively, and NH3-nitrogen increased by 30%. The improvement in the quality and net reduction in the pollutant load of the runoff were attributed to dilution with incoming base flow, sedimentation of suspended matter, and biological utilization of soluble organics and nutrients by bacteria and algae. Additionally, use of alkalinity and molecular nitrogen by algae could have caused the decrease in total hardness and the increase in NH3-nitrogen. (Baker-FRC)
W81-06239

CURRENT PROBLEMS OF SURFACE WATER QUALITY STANDARDIZATION,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. S. Kaminskii.
Water Resources (English Translation), Vol 7, No 3, p 273-279, May/June, 1980. 1 Tab, 31 Ref. Translated from Vodnye Resursy, No 3, p 160-168, May/June, 1980.

Descriptors: *Water quality, *Water pollution control, *Ecology, Surface water, Standards, Aquatic life, Fisheries, Aquatic habitats, Pollutants, Public health, Self-purification.

The Soviet Union Ministry of Health is developing maximum allowable concentrations for pollutants in surface waters. However, these standards have considered only the effects on humans, not the sensitive aquatic organisms. The author suggests a unified approach, incorporating the human and ecological standards into one system. Pollutants present in amounts harmless to man may profoundly affect an ecosystem even though aquatic life is not totally destroyed. Population compositions may change so that water self-purification or the food chain is disturbed. This could degrade water quality and cause problems for the fisheries industry. Tables comparing the maximum allowable concentrations of pollutants for the fisheries industry and for humans show that fisheries standards are much more restrictive. They prohibit some chemicals allowed for humans. Fisheries limits are generally several orders of magnitude lower than for humans. Future work should include studies on the additive effects of several pollutants and development of improved analytical methods, possibly combining bioindicators and chemical tests. (Cassar-FRC)
W81-06287

CONTROLLING WILDERNESS RECREATION: WHAT MANAGERS THINK AND DO,
Texas A and M Univ., College Station. Dept. of Recreation and Parks.
R. L. Bury, and C. B. Fish.
Journal of Soil and Water Conservation, Vol 35, No 2, p 90-93, March/April, 1980. 2 Tab, 18 Ref.

Descriptors: *Recreation, *Regulations, Public opinion, Public access, *Wilderness areas, Resources management, Management decisions, Decision making, Water management.

Many wilderness managers have begun to implement controls on the intensity and character of visitor use. Visitor controls involve trade-offs. Recreationalists may lose some freedom of choice, but environmental conditions may improve. Twenty-three controls available to wilderness managers are listed. Regulatory controls define where, when, or how visitors may travel or camp. Manipulative controls modify behavior in more subtle ways by manipulating the circumstances considered by visitors when they decide where to go and how long to stay. Two frequently used regulatory controls are limits on party size and limits on length of stay. Most Forest Service managers rated their five most frequently used controls as moderately effective. A majority of managers rated increased surveillance as highly effective. Regulatory controls were rated as more effective than manipulative controls. Overall public reaction was more positive to control by information dispersion. Additional evidence, however, indicated that a direct, general relationship exists between a control's effectiveness as perceived by the manager and his perception of public reaction to it. Wilderness administrators need to know more about visitor management techniques. (Baker-FRC)
W81-06343

COST-SHARING FOR MANURE HANDLING,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 6C.
W81-06361

WATER PROBLEM IN THE HILLS SOLVED BY U-V.
Water and Waste Treatment, Vol 23, No 1, p 2-3, January, 1980.

Descriptors: *Water quality control, *Ultraviolet radiation, Sterilization, *Water treatment, Drinking water, Potable water, Rural areas.

Steps were begun to ensure a good quality water in the rural supply obtained from fellside streams in the Cumbrian hills. The supplies had been untreated for years prior to the reorganization brought about by the Water Act of 1973. Although the raw water quality was good, it was felt that the water needed some treatment to be on the safe side, as cattle grazed on the fell sides where the water came down. Originally 5-micron ceramic filters impregnated with silver were used, but these became choked with sediment and had to be scrubbed at frequent intervals. An ultraviolet water sterilizer was installed in one of the supplies during the summer of 1978. The unit is designed around a cool running low pressure mercury vapour lamp, which has the advantage that the system will not overheat if the arc tube is alight and there is no flow through the sterilizer. The equipment uses the germicidal effect of 254 nm UV radiation to destroy or inhibit all known bacteria, viruses, and molds which might be present in the water. Installation of additional UV units is being considered for other streams feeding into Thirlmere, water from which is supplied to Manchester via 90 mile pipeline and to consumers enroute. (Baker-FRC)
W81-06386

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

APPRAISAL OF HYDROLOGIC INFORMATION NEEDED IN ANTICIPATION OF LIGNITE MINING IN LAUDERDALE COUNTY, TENNESSEE,
Geological Survey, Memphis, TN. Water Resources Div.
W. S. Parks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-239428, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey, Water-Resources Investigations 80-54, 1981. 67 p, 16 Fig, 8 Tab, 48 Ref.

Descriptors: *Planning, *Lignite, *Strip mines, *Baseline studies, Groundwater, Surface water, Water quality, Hydrologic data, Evaluation, *Tennessee, Lauderdale County, *Coal mining.

Lignite in western Tennessee occurs as lenses or beds at various stratigraphic horizons in the Coastal Plain sediments of Late Cretaceous and Tertiary age. The occurrence of this lignite has been known for many decades, but not until the energy crisis was it considered an important energy resource. In recent years, several energy companies have conducted extensive exploration programs in western Tennessee, and tremendous reserves of lignite have been found. Lauderdale County was selected as one of the counties where strip-mining of lignite will most likely occur. Lignite in this county occurs in the Jackson and Cockfield Formations, undivided, of Tertiary age. The hydrology of the county is known only from regional studies and the collection of some site-specific data. Therefore, in anticipation of the future mining of lignite, a plan is needed for obtaining hydrologic and geologic information to adequately define the hydrologic system before mining begins and to monitor the effects of strip-mining once it is begun. For this planning effort, available hydrologic, geologic, land use, and associated data were located and compiled; a summary description of the surface and shallow subsurface hydrologic system was prepared; the need for additional baseline hydrologic information was outlined; and plans to monitor the effects of strip-mining were proposed. (USGS)
W81-06089

ENVIRONMENTAL CONSIDERATIONS IN CORPS PLANNING,
Colorado Univ., Boulder. Dept. of Civil, Environmental and Architectural Engineering.
C. Brendecke, and L. Ortolano.
Water Resources Bulletin, Vol 17, No 2, p 248-254, April, 1981. 9 Ref.

Descriptors: *Water resources development, *Planning, Decision making, Administrative decisions, Environmental effects, *Environmental policy, Environmental protection, Environmental quality.

The implementation of Federal environmental policies in water resources planning by the US Army corps of engineers was investigated. One objective of the research was to identify planning practices and procedures which are effective in increasing the consideration given to environmental concerns in Corps planning and decisionmaking. The term environmental encompasses both the natural and social environments, and excludes issues relating to economic and technical feasibility of water projects. Survey data from samples of two types of Corps planning studies have been collected. The nature of significant environmental issues affecting the studies was ascertained. Information concerning administrative practices and communication patterns and extraorganizational coordination procedures was also studied. The relationships between these practices and procedures were examined, and the consideration given to environmental issues during plan formulation and modifications was statistically analyzed. It was determined that environmental issues received greatest consideration during the plan formulation decisionmaking stages, where District policies encourage interdisciplinary planning and direct communication between planners and those of environmental interest groups. When significant controversy exists, plan modification decisions reflect increased environmental consideration as compared to situations where significant controversy is lacking. (Baker-FRC)
W81-06180

CELLS-IN-SERIES SIMULATION OF RIVERINE TRANSPORT,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
H. G. Stefan, and A. C. Demetracopoulos.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 107, No HY6, p 675-697, June, 1981. 9 Fig, 3 Tab, 28 Ref.

Descriptors: *Solute transport, *River flow, Flow, *Model studies, Mathematical models, Simulation, Streamflow, Flow rates, Tracers, *Dye releases, Prediction, Path of pollutants, Water quality control.

A cells-in-series (CIS) formulation to simulate riverine transport of dissolved material in water quality models is presented. The characteristics of the model are compared to one using the conventional one-dimensional advection-dispersion (AD) equation, and the advantages and disadvantages of the CIS model are illustrated. Both models are applied to a 10.7 mile reach of the Upper Mississippi River, in which dye tracing experiments were conducted. The lump parameter in the CIS model is the number of cells into which a river reach is subdivided. Each cell is well mixed. Dissolved mterial and water cascade from cells in a given river reach were constant in the study described. CIS models produce skewness without additional terms in the transport equation. Retention of material in the cells is an integral part of the model formulation. Skewness is directly related to the number of cells used. The CIS model does not use a diffusion-type term to describe the dispersion process, which introduces a second-order derivative in the conversion of mass equation. The dispersion process is related to simple parameters such as number of cells, effective cell volume, and volumetric flow rate in the CIS model. Actual volumes of a river reach are not required for the application of the CIS model. These models are most useful for slowly moving and highly dispersive rivers. (Baker-FRC)
W81-06198

WATER AND PUBLIC POLICY IN WESTERN DEVELOPMENT,
Prairie Farm Rehabilitation Administration, Regina (Saskatchewan).
H. M. Hill.
Canadian Water Resources Journal, Vol 6, No 1, p 77-85, 1981.

Descriptors: *Water policy, *Canada, *Water resources development, Public policy, Resources development, Irrigation, Economic aspects, History, Policy making, Water transfer, Water storage.

The traditional role of western Canada as an economic hinterland is rapidly changing as the economy of the region becomes stronger and more diversified. The availability of water resources at the times and places where they are needed will be a major constraint on the continued economic expansion of the region. The west is now the fastest growing area of Canada, and the reduction of development constraints is central to the policies required for realizing the economic and social development aspirations of the growing population. With respect to water resources development, this may include providing the infrastructure required for resource development, improving the efficiency of water transportation systems, and developing long-term water supplies on the southern prairies which are not subject to periodic disruption by droughts. The planning process must consider the likely future situation rather than basing itself strictly on trend analysis. Decision-making criteria for major water diversions should also look to the future. Planning activities at this stage should include studies of biota transfer issues, documentation of future water uses in the three prairie provinces, documentation of future water uses in the northern territories prior to diversion of these waters, development of an appropriate decision-making process for projects involving interjurisdictional transfers of water, and planning of the pattern of water development. (Carroll-FRC).
W81-06267

ENVIRONMENTAL MANAGEMENT CONSIDERATIONS FOR THE ASSESSMENT OF INTERBASIN TRANSFER PROJECTS IN ALBERTA,
Calgary Univ. (Alberta).
B. Olding.
Canadian Water Resources Journal, Vol 6, No 1, p 96-105, 1981. 18 Ref.

Descriptors: *Interbasin transfers, *Environmental effects, *Project planning, River basins, Water transfer, Planning, Evaluation, Environmental protection, Environmental quality, Decision making, Canada, *Alberta.

Environmental planners have traditionally been responsible for conducting environmental overviews of particular water resources projects. However, this technique is not suitable for the evaluation of interbasin transfers. Advance river basin planning provides a means to identify the environmental resources of the river basin and their relationship to stream flows and to determine the value of those environmental resources to users. Environmental planners should be required to assess the impact of each of several possible sites for proposed dams and of corridor routings for proposed diversion canals and to assess the impact of altered stream flows on the aquatic systems involved. Several provincial agencies and associated disciplines must be involved in the implementation of advance river basin planning, and conflicts arising from methodological differences, uncoordinated scheduling, and uncoordinated resource allocation must be resolved on a regional level. Requests for resources by participating agencies should be referred to decision-making levels, where existing coordinating committees can develop integrated common objectives for the planning program. The coordination of agencies within the river basin planning program should result in integrated planning of environmental resources. This coordination and advance planning should enable the environmental planner to address the specific needs of assessing the target interbasin transfer project. (Carroll-FRC)
W81-06273

6B. Evaluation Process

HYDRO-ECONOMIC ANALYSIS AND PROJECTION OF IRRIGATION WATER DEMANDS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
D. F. Kibler, W. B. Crowley, E. L. White, and R. L. Bartel.
Institute for Research on Land and Water Resources, Pennsylvania State University, Research Project Technical Completion Report, April, 1981. 119 p, 27 Fig, 37 Tab, 1 Plate, 55 Ref, 5 Append.

Descriptors: *Irrigation efficiency, *Economic aspects, *Cost-benefit analysis, *Irrigable land, *Crop production, Crop yield, Irrigation water, Marketing, Cost analysis, Expenditures, Corn, Potatoes, Tomatoes, *Pennsylvania.

A hydro-economic evaluation of irrigation in Pennsylvania was undertaken to (1) assess economic costs and benefits associated with irrigation system expenditures and crop yield increases; (2) map irrigable areas; (3) identify potential water shortages; (4) project economically based irrigation demand with water availability; and (5) evaluate irrigation systems that are energy- and water-efficient. It was determined that irrigation of moderate-value cash crops, such as potatoes, is economically justified in Pennsylvania provided that irrigated water can be applied near the optimal water-stress point for the crop. Using potatoes as an example, the average net return to irrigation was $195.13 per acre under present market conditions. thus, the use of irrigation systems can increase significantly the net returns to the Pennsylvania farmer. A water-shortage index for irrigation in Department of Environmental Resources subbasins throughout Pennsylvania was determined. The index is expressed as the maximum acreage that can be irrigated in the sub-basin under optimum conditons without depleting available water supplies below the two-year, 30-day drought level. A probability distribution for annual net benefits was developed for given crops and irrigation policy or trigger points. Optimal irrigation policies for corn, potatoes, and tomatoes vary between 0.75 and 0.50 available moistures, depending on labor, energy, and interest rates. (Garrison-Omniplan)
W81-06052

NATIONAL HYDROPOWER STUDY,
Institute for Water Resources (Army), Fort Belvoir, VA.
J. R. Hanchey.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16,

1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980. p 8-12, 3 Ref.

Descriptors: *Hydroelectric power, *Water resources development, *Dams, Site selection, Public policy, Social aspects, Economic aspects, Environmental effects, Future planning, Damsites.

During the past decade, a number of factors, including steady increases in fossil fuel costs, rapid inflation of the costs of constructing thermal generation facilities, and increased public concern over the safety of nuclear generation have prompted not only a search for new energy alternatives, but also a reexamination of previously ignored or discounted alternatives. A comprehensive study was needed to examine the nation's undeveloped hydropower resources with today's criteria and to analyze the institutional and policy setting for hydropower planning, design, development, and utilization. Congress authorized such a study, the National Hydropower Study. A preliminary inventory of hydropower potential is nearing completion. Over 50,000 existing dams and undeveloped damsites have been identified and screened using criteria developed specifically for each major watershed in the nation. The number of sites deemed to be candidates for further study has been reduced to about 17,000. The second major element of the study includes the Policy and Technical Overview Studies. These studies are designed to identify the socio-economic, environmental, institutional and other policy issues affecting hydropower, assess their importance, and recommended policy modifications that will encourage a balanced use of the nation's water resources. (Moore-SRC)
W81-06106

HYDROPOWER STUDIES IN NEW ENGLAND,
Acres American, Inc., Buffalo, NY.
J. D. Lawrence.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980. p 38-50, 4 Fig, 4 Tab, 5 Ref.

Descriptors: *Hydroelectric plants, *Dams, *Feasibility studies, Cost-benefit analysis, Economic feasibility, Site selection, Water resources development, *New England.

Of the more than 2800 existing dams without power facilities identified in New England, more than 2,000 are less than 20 ft high and would probably not be economic to develop. Based on a series of studies to investigate hydroelectric potential in the New England region as a whole and also specifically in the States of Vermont, Massachusetts and Maine, a methodology has been developed for a reasonably rapid and yet reliable selection and ranking of preferred sites. A four-step procedure is followed. Following preparation of an inventory of sites, the first step is an initial screening process to eliminate sites at which there is an obvious environmental, institutional or economic impediment to development. The second step involves a further screening on the basis of preliminary considerations of costs and power and energy benefits within previously determined guidelines. The third step consists of classification and ranking of the remaining sites to be followed by selection of an optimum development program in step four. Conceptual cost estimates for screening purposes are regarded as comparative rather than absolute. Costs are based on specific site features such as dam length and height, type of intake, water passage and diversion facilities envisaged, plat capacity for the selected heat and flow, mechanical and electrical equipment, and the requirements for additional potentially expensive features such as fish ladders. (Moore-SRC)
W81-06107

SMALL-SCALE HYDROELECTRIC DEMONSTRATION PROGRAM,
Department of Energy, Idaho Falls, ID.
C. E. Gilmore, and G. L. Smith.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980. p 53-66, 10 Fig.

Descriptors: *Hydroelectric plants, *Feasibility studies, *Dams, Water resource develoment, Alternative planning, Economic feasibility, Economic aspects, Damsites, Availability head, Low head.

The objective of the Department of Energy's Small-Scale Hydroelectric program is to provide an option for greatly increasing the use of hydroelectric energy through the identification and development substantial small-scale hydro resources. The strategy is to promote rapid near term growth by accelerating utilization of the most readily accessible hydro resource, existing dams, with active commercial participation. To date, two major incentive programs have been conducted utilizing government financial participation in 54 hydroelectric feasibility assessments and 7 hydroelectric demonstration projects. The major objective of the PRDA (Program Research and Development Announcement) was to stimulate and accelerate the utilization of low-head hydroelectric power by providing the private and non-Federal public sectors with engineering and economic information based on the results of current, specific feasibility assessments ecompassing a variety of existing dam sites. The two major criteria for qualification under the PRDA required that the dam have a rated capacity of between 50 kW and 15 MW and a hydraulic head of less than 20 m. Proposals were also solicited in response to a Program Opportunity Notice (PON) for the design, construction, and operation of low-head hydroelectric power demonstration plants at the site of existing dams. Proposals were considered for financial support to demonstrate technical feasibility and economic viability by acquiring cost and performance data to verify marketing, environmental, safety, legal, ad institutional constraints associated with low-head hydroelectric development. The major criteria for qualification under the PON required that the dam have a rated generation capacity of 15 MW or less, a head of 20 m or less, and have a completed feasibility assessment for the project. (Moore-SRC)
W81-06108

DEVELOPMENT OF HYDROELECTRIC POTENTIAL,
Niagara Mohawk Power Corp., Syracuse, NY.
D. R. Bristol.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980. p 67-72.

Descriptors: *Hydroelectric plants, *Feasibility studies, *Cost-benefit analysis, Hydroelectric power, Economic feasibility, Licensing, Environmental effects, Water resources development, River basin development, Niagara Mohawk Power Corporation, *New York.

The planning process for small hydroelectric projects at Niagara Mohawk Power Corporation, New York, includes the evaluation of alternatives for general expansion, river basin studies, a program to develop hydro, a systematic method for developing specific sites within the program, and the ability to add or delete projects from the program. In order to have a small hydro site be of value in a large system, it must be coupled with an overall generation expansion plan. The approach used was to develop a substantial block of hydro power, say 200 megawatts or more. This block of capacity could then be traded off with the alternative methods. River basin hydro studies have provided an indicator for future hydroelectric development possibilities. These are relatively inexpensive undertakings providing an overall look at river system development, power possibilities under today's conditions, and conceptual costs of developing selected sites. Preliminary feasibility studies were used to verify costs in the river basin studies. Evaluation indicated that there was a slight economic advantage in pursuing a generation expansion program including small hydroelectric development. Since the information used in developing the program was conceptual in nature, it was necessary to develop a four step program to develop each site, consisting of feasibility, licensing, design, and construction. Aside from the planning process it is necessary during the feasibility and licensing phases to give due consideration to not only the economics but several other factors, such as land use, historic perservation, recreation, endangered species, fishery potential, water quality, and the regulatory process. (Moore-SRC)
W81-06109

UNDERGROUND PUMPED STORAGE,
Acres American, Inc., Buffalo, NY.
For primary bibliographic entry see Field 8A.
W81-06110

MODERNIZATION OF HYDROELECTRIC UNITS,
Allis-Chalmers Corp., York, PA. Hydro-Turbine Div.
For primary bibliographic entry see Field 8A.
W81-06111

SOCIO-ECONOMIC ASPECTS OF TVA HYDROPOWER,
Tennessee Valley Authority, Knoxville.
J. L. Davis.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980, p 111-114.

Descriptors: *Hydroelectric power, *Economic aspects, *Social aspects, *Water resources development, Navigation, Flood control, Water quality, Fish, Habitats, Recreation, *Multipurpose reservoirs, Tennessee Valley Authority.

The legislation which created the Tennessee Valley Authority (TVA) included provisions for the agency to enhance the economic and social well-being of the people of the region. This mission was to be accomplished through integrated resource development. TVA was specifically directed to provide a navigation channel to Knoxville, control the floodwaters of the Tennessee River, and generate electricity. The river system was also to be managed to achieve other benefits whenever feasible. Whenever rivers and streams are in flood stage or there is potential flooding, flood damage reduction has top priority in dam and reservoir operation. During periods of normal to low flows, hydroelectric power loads are distributed among hydroplants to make the most efficient use of available water. When reasonably consistent with primary objectives, water levels and streamflows are regulated to achieve selected social and economic objectives. Meeting these objectives often results in foregoing power benefits. These social and economic objectives include vector control, water supply, water quality, recreational use, and fish habitat enhancement. The addition of generating facilities to existing projects, uprating of existing hydroelectric generators and turbines, and the reassessment of existing projects may provide additional capacity plus social and economic benefits. (Moore-SRC)
W81-06113

ELICITING PUBLIC PARTICIPATION,
Montgomery County Office of Environmental and Energy Planning, Rockville, MD.
L. H. Fohs.
Journal of the American Water Works Association, Vol 73, No 5, p 246-250, May, 1981.

Descriptors: *Public participation, *Public relations, *Public hearings, Education, Water conveyance, Wastewater treatment, Wastewater facilities, *Water supply, Montgomery County, Prince Georges County, *Maryland.

Public participation necessary for the implementation of successful environmental programs is analyzed, and two case histories of planning studies are presented. Public participation can be achieved by developing an effective communication process and presenting information in a meaningful and understandable manner. Those responsible for a

program must be prepared to encourage an active exchange with the public. The establishment of a bicounty water supply system in Montgomery and Prince Georges Counties, Maryland, included a public participation program. Public meetings were scheduled and publicized which dealt with the effect of water supply problems, the frequency of drought periods and past problems, the limited water reserve for the bicounty area, and measures taken to resolve the problem. Another public participation study involved a three-step planning for an advanced wastewater treatment facility. The public participation program included public meetings, seminars, and field trips to aid in site selection for the wastewater treatment process. (Small-FRC)
W81-06170

MULTIDIMENSIONAL SCALING IN RECREATIONAL PLANNING,
Sheldons Engineering Ltd., Cambridge (Ontario).
J. E. Praskey, R. K. Weaver, E. A. McBean, and K. W. Hipel.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 106, No WRI, p 61-69, March, 1980. 2 Fig, 8 Ref.

Descriptors: *Recreation, *Planning, *Multiobjective planning, *Mathematical studies, *Attitudes, Water resources development, Resources development, Management planning, Aternative planning, Design criteria, Design standards, User charges, Benefits, Intangible benefits, Social benefits, Behavior.

Multidimensional scaling is an analytical technique which reveals structures and patterns inherent in empirical behavioral data. It transforms data into a geometric configuration by means of a set of matrices. Patterns are most clearly shown when dimensionality and stress, or variation, from the input source are minimal. This technique was successfully applied to the design of a recreational water resource facility, and it has potential application in other water resource management problems. (Titus-FRC)
W81-06174

TOTAL DOMESTIC WASTEWATER COSTS PEGGED AT $22 BILLION A YEAR,
Murphy (Sage) and Associates, Inc., Denver, CO.
M. J. Cullen, C. H. Burnett, and J. A. Chamblee.
Journal of the Water Pollution Control Federation, Vol 53, No 5, p 522-529, Ma, 1981. 1 Fig, 4 Tab.

Descriptors: *Wastewater treatment, *Economic aspects, Surveys, Water demand, Water supply, Costs, *Water treatment facilities.

A needs survey was taken in 1980 by the Environmental Protection Agency in compliance with sections 205(a) and 516(b) of the Clean Water Act. The results of this survey are reviewed in this article. The survey began with orientation meetings conducted in EPA regional offices where logistics, target dates, and individual state problems were discussed and resolved. Approximately 32,000 individual facilities in all 50 states and territories were included in the survey. The total expenditure for all wastewater functions for the base year of 1978 was estimated at about $22 billion in January 1980 dollars. The estimated 1981-2000 expenditure is $453 billion. The major limitation of this study was the exclusion of expenditures not directly related to domestic wastewater systems. No industrial-sector spending was included, nor was any expense related to stormwater control, other than for the correction of combined sewer overflow problems. The 1980 survey was noteworthy for its increased level of automation, efficiency and accuracy over prior surveys. By coupling the needs survey results with the results of the total needs study, a truly comprehensive picture emerges of what remains to be done in the area of domestic wastewater treatment, as well as the costs associated with operating these facilities. (Baker-FRC)
W81-06237

THE SASKATCHEWAN NELSON BASIN BOARD STUDY IN RETROSPECT,
For primary bibliographic entry see Field 4A.
W81-06269

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

MANAGEMENT OF RURAL DOMESTIC WATER SYSTEMS IN UTAH,
Utah Water Research Lab., Logan.
T. C. Hughes.
General Series UWRL/G-80/01, September, 1980. 21 p, 2 Tab, 3 Ref, 2 Append.

Descriptors: *Water rates, *Rural areas, *Water costs, *Economic aspects, Surveys, Springs, Cost analysis, Water policy, Operating costs, Operating policy, Deep wells, Water management, *Utah.

Utah's small domestic water systems have problems with high costs of service and isolation from sources of professional assistance, whereas the larger systems have a revenue base to support ongoing consultive services and well-trained operators. In addition, there is a strong correlation between the size of a system and the ability to pass water quality tests: the most common reason that community water systems are on the Division of Health's 'not approved' list is bacteriological contamination. In a project to assess the needs of these smaller systems and plan workshops for management and operator training, telepone interviews were conducted with 25 system representatives from 240 rural systems, each serving 25-600 families. The results indicated that rural system costs are high because each system serves an average of only 114 families, and although the cost of metering is high, 96 percent of the services are metered. The minimum monthly charge varies from zero to $33, and the number of thousand gallons allowed before exceeding the minimum charge also varies greatly. Many of the systems (51 percent) have access to springs that provide high-quality water at low cost, and 28 percent of the systems construct deep wells. The latter percentage may rise as development increases. Only 4 percent operate treatment plants. Repair costs are a major expense in 60 percent of the systems. Management is concerned about low salaries causing high employee turnover. (Garrison-Omniplan)
W81-06054

CUSTOMER METERING PRACTICES.
American Water works Association, New York.
Journal of the American Water Works Association, Vol. 73, No. 5, p 251-255, May, 1981. 1 Tab.

Descriptors: *Surveys, *Water metering, *Water distribution, Utilities.

A survey was conducted on utility practices, experiences, and problem in conducting meter programs. A questionnaire was sent to 438 utilities, 120 of which responded. Respondents indicated that they metered 88.9% of their systems, and 68% indicated no interest in testing new metrs. Twenty-two percent of the utilities do not test new meters themselves, and 59% return failed new meters to the manufacture. Forty percent indicated that there were problems with new meters. Twelve percent changed gears in-house and 9% had other solutions to fixing new metrs. Sixty percent of the utilities use remote-reading meters. The results of the survey and a sample of the questionnare are presented. Metering practices need to be studied on the basis of how they affect unaccounted-for water. Also, the progress of the Omaha automatic meter-reading test, which reads meters and transmits results by phone lines, is being monitored. (Small-FRC)
W81-06164

REGIONAL ALLOCATION OF WATER RESOURCES,
Naval Postgraduate School, Monterey, CA.
W. R. Smith.
Journal of the American Water works Association, Vol. 73, No. 5, p 226-231, May, 1981. 2 Tab, 28 Ref.

Descriptors: *Metropolitan water management, *Regional planning, *Water use efficiency, Water districts, Water conservation, Water resources development, *Monterey Peninsula, *California.

The Monterey Peninsula Water Management District, a government organization formed to ensure an adequate supply of water for the residents of the Monterey Peninsula, is described. The disrict was formed after the hardship of water rationing occurred during the 1976-77 drought. The district covers about 140 sq mi, and the board is made up of five elected members and two members appointed by the county board of supervisors and a selection committee of member cities. The district has broad powers in the areas of supply, demand, and planning. It controls the sale of water and water rights, the control of floodwaters, and the acquisition of public and private water systems. It has the power to control demand above the present usage rate and below it in times of emergencies. The major problem facing the district in the future is mobilizing public support for the solutions it recommends on the ballot. (Small-FRC)
W81-06168

ECONOMICS OF SLUDGE MANAGEMENT,
Drexel Univ., Philadelphia, PA. Dept. of Engineering.
For primary bibliographic entry see Field 5F.
W81-06241

COST-SHARING FOR MANURE HANDLING,
Purdue Univ., Lafayette, IN.
S. B. Lovejoy, L. L. Klessig, and N. W. Bouwes.
Journal of Soil and Water Conservation, Vol 35, No 1, p 47-49, January/February, 1980. 3 Tab, 7 Ref.

Descriptors: *Manure, *Cost sharing, *Economic aspects, *Water pollution control, Farm wastes, Animal wastes, Water pollution prevention, *Feedlot runoff, White Clay Lake, *Wisconsin.

The increasing threat of runoff from dairy feedlots and winter manure spreading to White Clay Lake, Wisconsin, prompted formation of a lake district under the Federal Clean Lakes Program. The EPA provided 50% of the funds or $107,000; the State of Wisconsin, 40% or $86,000; and the lake district 10% or $21,000, to create manure storage facilities, general barnyard improvements, and water diversions. The nine farmers involved liked the new system and were willing to contribute an average of 48% of the costs themselves. At the same time they felt that an average of 17% was a 'fair contribution' on their part. Rates for cost sharing would have to be consistent and high enough to attract enough participants. A cost-sharing rate of 50% is recommended. (Cassar-FRC)
W81-06361

6D. Water Demand

GROUND WATER MINING, WATER TRANSFERS, AND THE OGALLALA AQUIFER STUDY,
Nebraska Univ., Lincoln.
J. D. Aiken.
Department of Agricultural Economics Staff Paper No 5, 1981. 11 p, 9 Ref.

Descriptors: *Groundwater mining, *Groundwater prospecting, *Groundwater management, *Economic aspects, *Cost-benefit analysis, *Water rights, Groundwater depletion, Groundwater potential, Water policy, Administrative regulations, Public policy, Data collections, Federal jurisdiction, Ogallala aquifer.

Ground water reservoirs are often hydrologically related to surface supplies and other aquifers, and are rarely in a single ownership. Thus, ground water reservoirs are considered 'common pool' resources, such that excessive use leads to premature exhaustion. An increase in ground water use for irrigation has led to the mining of ground water in several states including California, Arizona, Kansas, and Texas, where withdrawls from

aquifers are at rates in excess of net recharge. In western states (California, Texas, Nebraska), where 60 percent of the ground water was withdrawn for irrigation in 1975, meaningful state or local controls on ground water have not existed. A more politically popular approach has been to import water supplies to augment diminishing ground water supplies. Of existing ground water control laws, the correlative rights doctrine addresses ground water mining, but use restrictions are unpopular with irrigators who perceive them as threats to their economic livelihood. Supply augmentation is locally more popular than ground water regulations. A Texas High Plains study will examine six development strategies to augment supplies in the Ogallala aquifer. Water importation to maintain irrigation in Texas and Kansas would require federal subsidies of up to $91.2 billion for construction, plus up to $12.7 billion per year for operation and maintenance. The discipline of ground water regulations may be more feasible for extending the life of ground water supplies. (Garrison-Omniplan)
W81-06056

SURFACE-GROUND WATER CONFLICTS IN NEBRASKA,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 6E.
W81-06057

LEGAL ASPECTS OF GROUND WATER RECHARGE,
Nebraska Univ., Lincoln.
J. D. Aiken.
Department of Agricultural Economics Staff Paper No 10, 1980. 19 p.

Descriptors: *Groundwater recharge, *Groundwater depletion, *Groundwater potential, *Legal aspects, Groundwater storage, Aquifers, State jurisdiction, Legislation, Water supply development, Water policy, Administration regulations, Public policy, California, Washington.

In the development of a ground water recharge project, relevant legal considerations include: (1) the right and associated legal duties of storing water underground; (2) rights to withdraw water stored underground; and (3) management authorities to implement recharge project objectives. Legal rights and duties associated with storing water underground are unclear regarding the right to store water under land not owned or controlled by the recharge entity, and regarding liability for damage caused by such storage. Rights to store water underground have not been explicitly defined by court decisions or by statutes. California and Washington recharge management policies differ in significant respects, owing in part to different water supply and use characteristics. Both states, however, authorize the control of recharge water withdrawls, although by different means. Both states also permit integrating the use of surface and ground water; in California to make the most effective use of all water supplies regardless of their sources, and in Washington to allow management of water stored underground as part of the total reclamation project water supply. Three questions are of concern when legislatively developing state ground water recharge policies: (1) whether costs should be financed through use charges at all; (2) whether the recharged ground water will be deliberately managed to achieve supply objectives; and (3) whether recharged ground water should be integrated with water from other sources. (Garrison-Omniplan)
W81-06059

INTERRELATIONSHIPS BETWEEN WATER ALLOCATION AND WATER QUALITY MANAGEMENT POLICIES,
Nebraska Univ., Lincoln.
J. D. Aiken.
Department of Agricultural Economics Staff Paper No 5, 1980. 9 p.

Descriptors: *Water quality, *Water supply, *Water management, Resources management, *Water allocation, Resource allocation, Instream flow, Groundwater pollution, Groundwater irrigation, Groundwater depletion, Administrative regulations, Legal aspects, Water conservation.

Water pollution policies developed independent of environmental concerns and water quality objectives have been established without careful consideration of their impact in water use patterns, customs, and institutions. Two major water quality impacts are the direct result of state water allocation decisions. First, groundwater and surface water withdrawals can reduce streamflow and interfere with instream needs. Second, the quantities of ground and surface water allocated for irrigation may be large enough to cause runoff or deep percolation of dissolved chemicals, resulting in decreased groundwater and surface water quality. Restriction of ground and surface water withdrawals that interfere with instream use can effectively protect water quality where sufficient unallocated water is available and reserved instream uses. Where this is not the case, water for instream uses can be obtained only through purchasing existing water rights and converting them to instream uses, or by physically augmenting streamflow. Groundwater and surface water pollution from irrigation can be addressed by reducing existing and future water allocations that require use of irrigation or other water conservation techniques. Because inefficiency has been tolerated in the past, requiring strict irrigation water conservation would be politically courageous and risky. The restrants on implementing an irrigation water conservation policy are primarily political and economic. Any changes are likely to come from either an administrative agency or from the Legislature. (Garrison-Omniplan)
W81-06060

NEW MEXICO RESIDENTS' ATTITUDES TOWARD WATER USE AND MONETARY TRADEOFFS,
New Mexico State Univ., Las Cruces. Dept. of Marketing and General Business.
E. R. Pratt, and S. Martin.
New Mexico Water Resources Research Institute, New Mexico State University. WRRI Report No 129, December, 1980. 72 p, 12 Tab, 26 Ref, 5 Append.

Descriptors: *Economic aspects, *Water use, *Water users, *Surveys, *Water resource development, Water pollution control, Public policy, Resource allocation, Water conservation, Water supply, Local governments, State jurisdiction, Tax rates, *New Mexico.

For water resources development to be meaningful, it must be responsive to the needs and desires of the public. The purpose of this study was to identify and examine, through a mail survey in both English and Spanish, New Mexico residents' attitudes toward their water resources. Of 590 households surveyed, 310 returned usable questionnaires. Part I of the survey dealt with the state's water resources, Part II covered New Mexico's Governmental Water Pollution Program, and Part III queried respondents on water use tradeoff. The following attitudes were identified: (1) the New Mexico government should be involved in water resources problems; (2) all forms of recreation should be available to everyone; (3) the problems of water pollution are not widely known; (4) the government's role in water pollution control has not been well defined to the public; (5) more people agree than disagree that nuclear energy should be encouraged by the state; (6) water pollution should be handled at the state level, not by local, county, or federal governments; (7) the state's water pollution programs are not widely known; (8) most people are not willing to pay additional taxes to reduce water pollution; (9) many people are attempting to conserve water; and (10) industrial water pollution is believed to be more serious than home or agricultural pollution. Only general attitudes were surveyed; additional research is needed to determine exact attitudes as well as opinions about specific issues. Suggestions for future planners who use questionnaires are outlined. (Atkins-Omniplan)
W81-06062

WATER FOR THE SUNBELT: A GLOBAL PERSPECTIVE,
New Mexico State Univ., Las Cruces.
G. W. Thomas.
In: Proceedings of the Twenty-Sixth Annual New Mexico Water Conference, Water for a Growing and Changing Sunbelt State, Las Cruces, March 26-27, 1981. p 11-28. New Mexico Water Resources Research Institute, New mexico State University, Las Cruces, Report No 134, June, 1981.

Descriptors: *Competing use, *Future planning, *Population dynamics, *Water allocation, Water rights, Legal aspects, Agriculture, Aquifer management, Water management, Potential water supply, Water resources, *Southwestern US.

The shortage of water is more critical in the long term than the shortage of energy of land. Energy is critical to food production and economic development, but there is an adequate supply if it can be captured. Crop land is being lost to industrialization, but there is still flexibility in this resource. Worldwide, the major areas for food production will be arid and semi-arid lands, in moderate to low rainfall areas. The largest per capita water requirement is for food, yet agriculture cannot compete successfully for water against municipalities, business, and industry. Growth in the sunbelt can halt quickly if plans are not made now to meet water needs. Data from the 1980 census show that while the U.S. grew 11.4 percent during the 1970s, New Mexico grew 27.8 percent; Texas, 27.1 percent; Arizona, 53.1 percent; Nevada, 63.5 percent; Utah, 37.9 percent; California 18.5 percent; and Colorado, 30.7 percent. All of these states are water-short and solar energy-rich, which indicates the needed directions for future research. Research on photosynthesis will not only help find ways to capture more energy from the sun but will increase water efficiency. Unfortunately, not enough research is designed with water as a constraint. It is obvious that we will reach the economic limits of the Ogallala aquifer long before we reach the engineering and technological limits. Research is needed also in developing drought-resistant and salt-tolerant crops, reducing the amount of leaching water, and developing low pressure drip irrigation systems. (Garrison-Omniplan)
W81-06063

THE UNITED STATES SUNBELT - REALITIES OF THE FUTURE,
New Mexico Univ., Albuquerque. Inst. of Applied Research Services.
L. B. Zink.
In: Proceedings of the Twenty-Sixth Annual New Mexico Water Conference, Water for a Growing and Changing Sunbelt State, Las Cruces, March 26-27, 1981. p 29-38. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, Report No 134, June, 1981.

Descriptors: *Overdraft, *Irrigation efficiency, *Irrigation requirements, *Groundwater management, Agriculture, Agricultural watersheds, Population dynamics, Future planning, Potential water supply, Groundwater depletion, Water use, Economic aspects, *Southwestern US.

Population growth projections in the sunbelt--Arizona, Nevada, New Mexico, Oklahoma, Texas, Kansas, Colorado and Utah--show these states growing much faster during 1990-2000 than the national average of 0.8 percent per year. Total personal income is expected to exceed the national average of 3.3 percent per year. In the face of these changes, the depleting water supply is a major problem. A 1980 General Accounting Office (GAO) publication called 'Overdrafting Must Be Controlled' calls attention to the depleting of groundwater resources of the West and Midwest. Overdrafting can cause land subsidence, salt water intrusion into fresh water aquifers, reduced surface water flows, increased energy consumption, and disruption of social and economic activities. The GAO report states that overdrafting is most serious in the arid and semi-arid western states where irrigation of crops accounts for over half of all groundwater use. Continued depletion ultimately leads to resource exhaustion: irrigation becomes limited; farmers resort to rainfall-watered farming;

and local recessions and a general weakening of the regional economy occur. The GAO report pinpoints the high plans region of western Texas and eastern New Mexico as the most likely place for economic breakdown due to groundwater depletion. Additional economic change in the sunbelt will result from water decisions regarding supplies needed for the proposed MX missile system and development of energy resources. (Garrison-Omniplan)
W81-06064

WATER FOR AGRICULTURE IN A COMPETITIVE ENVIRONMENT,
New Mexico State Univ., Las Curces. Dept. of Agricultural Economics and Agricultural Business.
G. R. Dawson.
In: Proceedings of the Twenty-Sixth Annual New Mexico Water Conference, Water for a Growing and Changing Sunbelt State, Las Cruces, March 26-27, 1981, p 42-49. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, Report No 134, June, 1981.

Descriptors: *Agriculture, *Foods, *Farms, Population dynamics, Future planning, *Economic aspects, Competing use, Agricultural watersheds, Water rights, Water management, Water supply, Dry farming, *Irrigation water, *New Mexico.

Agriculture in New Mexico suffers when compared to other economic concerns, such as mining, oil, gas, and recreation; however, the problem of future food production nationally and globally demands that agriculture be given a higher priority in water allocations. It is important to know whether the limited water is being allocated in the proper mix of uses to yield the highest economic and social returns over the long haul, or whether allocation decisions are being made for short-run economic gains without considering long-haul social and economic consequences. When short-run economic returns guide resource allocation decisions, agriculture will be the low bidder for water and nonagriculturists will purchase the water out of agriculture; the agricultural base will decline because of population pressures and loss of water, the demand for food will continue to increase, and the nation will shift from a food surplus to a more balanced supply-demand situation, then to a possible deficit, with the result that food costs will likewise increase in real terms. Increasing pressure for food exports will strain our land and water resources, and urge all-out production. Population growth in Mexico will at least triple the rate for the U.S., and irrigated acreage will decline to less than 750,000 acres from over one million today. There will be fewer and larger farms, with water the principal limiting factor in efforts to increase production; water will then become more expensive. The potential for every set of allocation decision needs to be carefully considered. (Garrison-Omniplan)
W81-06065

A MUNICIPAL PERSPECTIVE,
K. M. Needham, and D. C. Andrews.
In: Proceedings of the Twenty-Sixth Annual New Mexico Water Conference, Water for a Growing and Changing Sunbelt State, Las Cruces, March 26-27, 1981. p 50-61, 5 Fig. New Mexico Water Resources Research Institute, Report No 134, June, 1981.

Descriptors: *Municipal water, *Water management, *Water rights, Water supply, *Potential water supply, Population dynamics, Competing use, Future planning, Water resources, Legal aspects, River basins, *New Mexico.

The Lower Rio Grande Basin extends from Broad Canyon north of Radium Springs to the New Mexico-Texas state line to the south, and includes approximately 1585 square miles. The 'declared' area, cited by the State Engineer in 1980 as an area within the Basin in which further groundwater appropriation was permitted only when other groundwater and surface water rights were not impaired, impacted 50 water supplies such as private water systems, mutual domestics, mobile home parks, and New Mexico State University. Each of these supplies faces similar problems securing water for growth. When the Basin was declared, the City of Las Cruces had a total system capacity of 28,399 acre-feet per year, of which 60 percent, or 17,040 acre-feet per year, may be pumped before retiring additional water rights. Projections are that this latter amount of pumpage will serve about 58,800 people, or 13,000 acres of development. At expected growth rates, this population should occur in 1990. At that time, for each acre of valley land that is developed, 2.2 acres of mesa land without existing water rights can be developed. The impact on the growth of Las Cruces will be that as land must be annexed, land water rights must be turned over to the city at the ratio of 1:2.2 in order to secure adequate water rights. Las Cruces has the right to deplete river flow 8,500 acre feet, and could support a population of 1.4 million if all agricultural water rights in the valley were retired to the City. (Garrison-Omniplan)
W81-06066

WATER FOR INDUSTRY IN NEW MEXICO'S FUTURE,
New Mexico Bureau of Mines and Mineral Resources, Socorro.
W. J. Stone.
In: Proceedings of the Twenty-Sixth Annual New Mexico Water Conference, Water for a Growing and Changing Sunbelt State, Las Cruces, March 26-27, 1981. p 62-77. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, Report No 134, June, 1981.

Descriptors: *Industrial water, *Mineral industry, *Alternative water use, Competing use, Water allocation, Fuel, Mine drainage, Water management, Future planning, Economic aspects, Hazardous materials, Water supply, *New Mexico.

This paper projects future industrial water needs and identifies potential conflict areas. New Mexico industry is divided into two categories: extractive and non-extractive. Manufacturing industries, a principal source of jobs elsewhere, are limited in New Mexico to nonwater-intensive activities. In extractive industries--those involved with mineral resources--the estimated volume of new water required for use in the year 2000 will be greater for processing fossil fuels than for the copper and potash industries. In terms of volume of water which could be depleted in the year 2000, fossil fuels and copper remain in the same ranking, but uranium is third. If such depletion is viewed in terms of the percentage of new water exhausted in 2000, fossil-fuel processing remains in the first position, the uranium industry is second, and the copper industry is third. The rankings change little for the year 2020. Non-extractive industries are those which manufacture goods or provide a service. The manufacturing industry in New Mexico is concentrated in major municipalities. Products are small by industrial standards and their fabrication is not water-intensive. Instead, water is used mainly for employee comforts. Similarly, service industries are not water-intensive and seldom threaten water resources. The exception is the waste disposal industry, where the major problem is not water supply but rather one of isolating hazardous waste from area water resources. Future water resources research should be in the areas of conservation, management, regulation, and alternative supplies. (Garrison-Omniplan)
W81-06067

THE FUTURE OF RECREATION IN NEW MEXICO,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Economics and Agricultural Business.
F. Ward.
In: Proceedings of the Twenty-Sixth Annual New Mexico Water Conference, Water for a Growing and Changing Sunbelt State, Las Cruces, March 26-27, 1981. p 78-82. New Mexico, Water Resources Research Institute, New Mexico State University, Las Cruces, Report No 134, June, 1981.

Descriptors: *Recreation, *Water sports, *Recreation demand, Value, Competing uses, Water allocation, Future planning, Economic aspects, Water management, Water supply, Economic justification, Monetary returns, Water resources, *New Mexico, Fishing, Boating, Swimming.

Over half of New Mexico's outdoor recreation is water-oriented. Several kinds of recreation become severely constrained or of reduced quality when water becomes less available, including fishing, boating, swimming, and waterfowl hunting. New Mexico's population has increased by 27 percent in the past ten years, and leisure time is increasing; yet more water cannot be allocated to recreation without reducing the water available to agricultural, municipal, and industrial users. All water users 'need' the water--unfortunately, the state water markets do not establish a value for water allocated to recreation, as they do for agricultural and industrial users in the process of exchanged water rights. Recreational water users spend money that impacts various New Mexico communities, especially those near recreational water sources such as at Truth or Consequences. The monetary value to New Mexico of water used for recreation will continue to grow as population grows, and decision-makets need to know the value of this water, so that it can be contrasted with municipal values as well as those in agriculture and industry. Research is needed to quantify the current economic value of water in recreation, as well as the future benefits. This could affect such aspects as changing access to sites, constructing additional impoundments, changing diversion patterns, and rationing facility use to reduce congestion. (Garrison-Omniplan)
W81-06068

COORDINATED OPERATION OF MID-COLUMBIA RIVER HYDRO PROJECTS,
Dunstan, Inc., Portland, OR.
L. A. Dunstan.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980, p 97-107. 1 Fig.

Descriptors: *Electric power production, *Hydroelectric plants, *Automation, Regulated flow, Reservoir operation, Flow control, Reservoir releases, Computers, Columbia River, Washington.

The seven Mid-Columbia hydroelectric projects under coordinated moment by moment dispatch are located on the Columbia River in central Washington State. These plants utilize a gross head of 890 ft, and monthly average flows range from 288,000 cfs to 48,000 cfs. The seven dams include Grand Coulee, Chief Joseph, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids. Prior to hourly coordination, each purchaser and the government requested power from each project to meet his needs and observe contractual limitations. Hourly coordination is a modification of previous operations designed to hold ponds full by altering the uncoordinated generation at all projects, combined with an accounting system designed to maintain the rights and obligations of all parties. Each control center sends signals to Central representing uncoordinated desired generation at each project. Central then sums the total uncoordinated desired generation, and in accordance with operating strategy, determines the coordinated generation at each project to meet the total desired generation. Central then sends back to each control center a signal, the coordination bias for each project so that the control center can dispatch the project uncoordinated desired generation plus coordination bias. Signals are exchanged and coordination bias is computed each four seconds in order to follow the load shape. After implementing hourly coordination, under certain water conditions, the system runs at capacity several daytime hours, and approaches minimum loadings during graveyard hours. (Moore-SRC)
W81-06112

HYDROELECTRIC POWER,
Water Resources Council, Washington, DC.
F. S. Davenport.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16,

1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980, p 202-225. 5 Fig, 10 Tab, 1 Ref.

Descriptors: *Hydroelectric power, *Water resources development, *Competing use, Habitats, Water use, Water pollution, Water quality, Groundwater, Instream flow, Water supply, Water pollution effects.

The objective of the Second National Assessment was to identify and describe the Nation's severe existing and emerging water resource problems. Water data were compiled for each of the Council's 21 water resources regions and 106 subregions. The following critical problems were concluded to be of national interest: inadequate surface water supply; groundwater overdraft; pollution of surface water; pollution of groundwater; drinking water quality; flooding; erosion and sedimentation; dredging and spoil; wet soils drainage and wetlands; and degradation of bay, estuarine and coastal water. With ever-increasing offstream and instream demands being made on the Nation's water resources, proposals for development of hydroelectric resources must recognize that competition for water supplies is a fact. Hydro projects can deplete water resources through evaporation, and changes in stream flow can impact on downstream water quality, fish and wildlife habitats, navigation, recreation, stream banks, diversion capacity, and groundwater storage. Hydroelectric power production is also sensitive to future changes in use by upstream users. These changes should be considered during project formulation and design of operational procedures. Underlying these various competing factors for water utilization are numerous institutional considerations for water resources management. (Moore-SRC)
W81-06117

EVOLUTION OF A REGIONAL SYSTEM,
Indianapolis Water Co., IN.
J. D. Bakken.
Journal of the American Water Works Association, Vol. 73, No. 5, p 238-242, May, 1981. 4 Ref.

Descriptors: *Metropolitan water management, *Regional planning, *Water supply, Water use efficiency, Utilities, marketing, Indianapolis Water company, Indiana.

The evolution of the Indianapolic Water company, which had its beginnings in 1871, is described. Through selective marketing of main extensions and acquisitions, the company has exapnded since 1947 into a widespread regional system which provides retail water service to most of Indianapolis-Marion county and to both incorporated and unincorporated portions of three adjacent counties. The total average consumption in the ten suburban pressure districts created by regionalization is about 45 mgd. This investor-owned company utilizes careful planning in the areas of management, finance, and engineering. The company continues to offer new regional water service by marketing main extensions, developing satellite supply and distribution systems, and acquiring existing utilities. Over the past 10 years it has acquired four existing utilities serving more than 2000 customers. (Small-FRC)
W81-06163

THE VALUE OF WATER IN THE GRAND RIVER BASIN: AN ESTIMATE OF THE DEMAND FOR WATER IN ONTARIO,
Guelph Univ. (Ontario). Dept. of Economics.
C. Macerollo, and M. Ingram.
Canadian Water Resources Journal, Vol 6, No 1, p 51-63, 19°1. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Economic aspects, *Water demand, *Mathematical studies, Cost-benefit analysis, Mathematical equations, Water rates, Prices, Canada, *Ontario, Grand River, Municipal water.

In order to perform a cost-benefit analysis of various water management options for the Grand River Basin, located in southern Ontario, it was necessary to have some idea of the value of water to the society. This study sought to develop an estimation of society's response to change in the price of water using data from 56 municipalities in southern Ontario. The price elasticity of demand for water, obtained through an estimation of the demand curve for water, is used to represent this response. Several demand equations were estimated in which municipal consumption was defined as a function of income, precipitation, the flat rate, three marginal prices, and industrial employment. Cost was estimated as a function of consumption, design capacity, and source type. Since no data were available for capital costs, only operating costs were represented by this equation. Although a large number of price equations were estimated, the results were uniformly poor. A 'pooled price' equation, which used a weighted index of the three marginal prices, was selected for use in estimating the demand elasticity. Two stage least squares estimations were then undertaken to eliminate the possibility of simultaneous equation bias. (Carroll-FRC)
W81-06268

THE RIVER CLWYD AUGMENTATION/ABSTRACTION SCHEME,
Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
A. O. Lambert.
Journal of the Institution of Water Engineers and Scientists, Vol 35, No 2, p 125-134, March, 1981. 3 Fig, 1 Tab, 6 Ref.

Descriptors: *Water demand, *Water supply development, Water resources development, Groundwater potential, *Wales, Flow augmentation, Geology, Rivers, Economic aspects, Induced recharge, Coastal area.

The River Clwyd Augmentation/Abstraction Scheme was designed to meet increases in demand for potable water along the coastal area of northeast Wales over the ensuing 15 to 20 years and to ensure reliable supplies for both the resident population and the large seasonal tourist influx in the summer. The scheme is small by national standards. Novel features of the scheme are the use of artesian boreholes for river augmentation discharges and the statutory power to use mains water for river augmentation discharges in appropriate circumstances. Abstraction boreholes alongside a river employing the induced recharge principle are not commonly used now in new United Kingdom schemes, although predecessors to this scheme recognized the benefits of such developments. The Liannerch site shows that thorough site investigations may lead to considerable economies in the final scheme, provided that the limits imposed by natural hydrogeological factors at the site are not an undue constraint. The Clwyd scheme is an example of making the best use of existing and natural resources, and demonstrates the value of careful hydrological and hydrogeological investigations along with a positive approach by officers and members to local public relations and scheme promotion. (Baker-FRC)
W81-06380

6E. Water Law and Institutions

SURFACE-GROUND WATER CONFLICTS IN NEBRASKA,
Nebraska Univ., Lincoln.
J. D. Aiken.
Department of Agricultural Economics Staff Paper No 3, 1981. 13 p, Append.

Descriptors: *Surface-groundwater relations, *Municipal water, *Water rights, *Streamflow depletion, *Judicial decisions, Appropriation, Multiobjective planning, Wells, Well regulations, Groundwater recharge, Water supply development, Groundwater storage, *Nebraska.

In many parts of Nebraska, ground and surface water supplies are physically interrelated. Where this occurs, ground water withdrawls can reduce streamflow, interfering with surface water uses. Wells located near a stream can induce direct ground water recharge; wells located further away can reduce streamflow over time. Similarly, reductions in streamflow from impoundent or surface water withdrawals can reduce ground water recharge. In Nebraska many municipalities, including Omaha and Lincoln, have deliberately located municipal wellfields near the Platte River to induce rapid ground water recharge of their high-capacity wells. A significant reduction in streamflow could similarly reduce recharge. This report reviews legal classifications of ground water, overlying rights theories, prior appropriation, and Nebraska water law as it relates to surface-ground water conflicts. Judicial and legislative alternatives are described for resolving surface-ground water conflicts. In judicial alternatives, a court could follow the subflow or tributary ground water doctrines in resolving surface-ground water conflicts. Reasonable use, correlative rights, the Restatement rule, burden of proof, and the balancing of equities are various other judicial alternatives. One of the foregoing alternatives could be specified by statute as the legal basis for resolving surface-ground water conflicts, as could concepts involving cut-off lines and supply augmentation. (Garrison-Omniplan)
W81-06057

WESTERN GROUND WATER RIGHTS: AN OVERVIEW,
Nebraska Univ., Lincoln.
J. D. Aiken.
Department of Agricultural Economics Staff Paper No 7, 1980. 34 p.

Descriptors: *Water rights, *Surface-groundwater relations, *Legal aspects, *Administrative decisions, *Resources management, Water allocation, Groundwater depletion, Groundwater mining, Stream discharge, Groundwater management, Water supply, Competing use, Western US.

This paper provides a broad overview of western ground water law, focusing on those aspects unique to ground water allocation and use, including: (1) legal classification of ground water; (2) legal theories of ground water ownership and use; (3) protection of the means of ground water diversions; (4) ground water mining; (5) conflicts between users of ground and surface water; and (6) emerging ground water policy issues. In many parts of the West, ground water and surface water supplies are physically interrelated; where this occurs, ground water withdrawls can affect streamflow and vice versa. Where appropriation applies to both surface and ground water, any surface-ground water conflicts will be resolved on the basis of priority. Where different allocation rules apply to surface and ground water, the adoption vel non of the subflow doctrine will determine how surface-ground water conflicts are resolved. Various overlying rights theories apply in each state, as does prior appropriation. Where surface and ground water resources constitute a common source of supply, the rights to use should be correlated. The subflow and tributary ground water doctrines provide an effective means for doing so. Whether the basis for interrelating surface and ground water rights should be prior appropriation or correlative rights depends on the nature of the hydrologic system. (Garrison-Omniplan)
W81-06058

LEGAL ASPECTS OF CONFLICTS BETWEEN USERS OF SURFACE AND GROUND WATER,
Nebraska Univ., Lincoln.
J. D. Aiken.
Department of Agricultural Economics Staff Paper No 1, 1980. 17 p.

Descriptors: *Water supply, *Water rights, *Surface-groundwater relations, *Legal aspects, *Resource allocation, Resource management, Decision making, Administrative decisions, Future planning, Groundwater depletion, Water law, Water allocation, Aquifer management, *Nebraska.

During 1979, members of the Nebraska Unicameral met informally to educate themselves ragarding Nebraska's water problems and to consider the development of water legislative proposals. This report presents five memoranda which discuss surface-groundwater conflicts. The resolution of these conflicts is one of the most complicated issues

facing policy makers in Nebraska. Legal alternatives include doing nothing, a judicial resolution, establishment of legal presumptions regarding interference and noninterference, regulating tributary groundwater as streamflow (the Colorado approach), and equitable apportionment (stream-aquifer management). Ground water development in eastern Colorado and southwest Nebraska increased rapidly; the result is that the Frenchman River, on which Enders Reservoir is located, is projected to stop flowing during 1990-2000 if current ground water development trends continue. Three alternatives for this area are to maintain the existing system, follow surface water law or prior appropriation, or follow ground water law or correlative rights. If the latter approach is used, it is important to determine what quantity of water is allocated to water users, how supplemental water is provided to surface water users and who pays for it, and how the system is administered. The report includes suggested administrative resolutions and a groundwater legislative proposal. (Garrison-Omniplan)
W81-06061

WATER QUALITY PROBLEMS: PERMITTING DISCHARGES FROM HYDROELECTRIC DAMS UNDER THE CLEAN WATER ACT,
Arnold and Porter, Washington, DC.
G. P. Nowak.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980, p 177-186. 18 Ref.

Descriptors: *Environmental effects, Dam effects, *Hydroelectric plants, *Legal aspects, *Reservoir releases, Permits, Water quality, Dissolved oxygen, Water pollution control, Trace elements.

The National Wildlife Federation and other plaintiffs have sued the Corps of Engineers and the Environmental Protection Agency in an attempt to enjoin construction of the Russell Dam on the Savannah River. The plaintiffs have alleged that the Corps is in violation of the Federal Water Pollution Control Act Amendments of 1972 because it has not obtained a Section 402 permit. When water in a free-flowing stream is impounded in a large storage reservoir, such as occurs after construction of a hydroelectric dam, changes often result in the quality of the water. Two of the most widely recognized problems are a decrease in oxygen and a significant increase in the concentrations of metallic compounds in the lower levels of the lake. The subsequent discharge of this oxygen-deficient water containing high concentrations of such elements as iron, manganese, and mercury will not only degrade the quality of water below the impoundment but can also destroy downstream fisheries. The Clean Water Act provides that, except as in compliance with the permit requirements under Section 402, the discharge of any pollutant to navigable waters from any point source is illegal. In those cases where the discharge from hydroelectric dams will be oxygen deficient, contain increased concentrations of metallic substances, or other pollutants, a Section 402 permit should be required. (Moore-SRC)
W81-06116

STREAMLINED LICENSING OF SMALL-SCALE HYDROELECTRIC PROJECTS IN MASSACHUSETTS,
R. L. Dewees, Jr.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fot Belvoir, Virginia, 1980, p 284-287. 3 Ref.

Descriptors: *Hydroelectric plants, *Licensing, *Legal aspects, Governmental interrelations, Interagency cooperation, Environmental effects, State jurisdiction, Low-head hydro development.

The streamlined licensing process for small scale hydroelectric development will remove some of the legal obstacles to low-head hydro development by simplifying state licensing requirements and by improving coordination between state and federal licensing requirements. In Massachusetts, the licensing of a small hydroelectric site can involve 19 different statutes administered by up to eight state agencies or departments. The key to the new licensing procedure is the designation of a lead agency, the Energy Facilities Siting Council (EFSC) to coordinate licensing. The new procedure will apply to all hydroelectric facilities under 100 MW. The EFSC will develop a standard application form that will include the information required by all individual permitting agencies. The developer need only complete it once, and copies will be sent to all agencies. All state agencies have 90 days in which to render a decision on their particular permit. The EFSC, as lead agency, will serve as the contact with the state for the Federal Energy Regulatory Commission. If an agency denies a permit, imposes a burdensome condition on the project, or fails to issue a decision within 90 days, the developer may appeal to the EFSC. The Siting Council may overrule the denial of a particular permit if the need for the energy supplies by the development outweighs its environmental impact. (Moore-SRC)
W81-06118

THE QUANTIFICATION AND RESERVATION OF INSTREAM FLOWS,
Fish and Wildlife Service, Fort Collins, CO.
For primary bibliographic entry see Field 7B.
W81-06149

THE U.S. PROGRAM TO MEET WATER QUALITY STANDARDS,
Environmental Criteria and Assessment Office, Research Triangle, NC.
J. F. Stara, and J. Krivak.
Water Science and Technology, Vol 13, No 3, p 267-275, 1981. 1 Fig, 5 Tab, 9 Ref.

Descriptors: *Public participation, *Water quality standards, *Aquatic life, *Public health, Standards, Toxicity, Fish, Industrial wastes, Heavy metals, Metals, Drinking water, Wildlife, Risks, Crump models, Carcinogens, Organoleptic properties, Legislation, *Water management.

The EPA approach to developing water quality criteria standards involves designation of water-use categories, development of criteria to achieve and maintain the designated uses, application of uses and criteria to specific streams, and implementation of standards through public and private actions. Active public participation in all phases of implementing environmental management programs is inherent in the legislation pertinent to existing water quality, the Federal Water Pollution Control Act of 1972 and the Clean Water Act of 1977. Progress has been made in development of these criteria, but there are still gaps in necessary data on toxicity to aquatic life and mammalian health effects. The development of the list of 65 priority pollutants is described. Criteria considered in protecting human health are carcinogenicity, toxicity, and organoleptic factors. Several models for determing risk levels are discussed, and the results compared for several toxic materials. Criteria for aquatic life consider many factors, including differences between salt and fresh water effects, species, and bioconcentration factors. (Cassar-FRC)
W81-06150

STATE INITIATIVES FOR REGIONALIZATION,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. A. Okun.
Journal of the American Water Works Association, Vol 73, No 5, p 243-245, May, 1981. 7 Ref.

Descriptors: *Regional planning, *State jurisdiction, *Water supply, Metropolitan water management, Legal aspects, Water law, Water use efficiency.

State initiatives to promote regionalization of water management are discussed and several successful and unsuccessful initiatives are analyzed. Regionalization of water management offers the advantages of economies and efficiencies of scale. Initiatives at the national level were extremely successful in England and Wales, but state initiatives are more appropriate in the U.S. In North Carolina, the first major thrust toward regionalization resulted from the Regional Water Supply and Sewage Disposal Planning Acts of 1971, and the state provided substantial funds through the Clean Water Bond Acts of 1971 and 1977. A legislative study commission created in 1979 found that regionalization of water management was sufficiently threatening that considerable work must be done at the grass roots level to obtain electorate support. Legislation in Washington requires the team approach where local government officials, land-use planners, and water system purveyors work together to come up with an acceptable plan for regionalization. Pennsylvania uses a similar approach while Maryland provides services to communities only at their request. (Small-FRC).
W81-06169

REPORT OF COMMITTEE ON FEDERAL ACTIVITIES,
New England Water Works Association, Boston, MA.
Journal of the New England Water Works Association, Vol 95, No 1, p 57-65, 1981.

Descriptors: *Drinking water, *Legal aspects, Waste disposal, Judicial decisions, Regulations, Water law, Research priorities, Landfills, Water policy, Law enforcement, *Water pollution control, Water resources development, Federal jurisdiction.

The New England Water Works Association Committee on Federal Activities reported on bills being considered by Congress (deregulation of contaminants with unproven health risks, the 'Superfund' to pay for cleanup and damages connected with toxic waste dumps, establishment of a national groundwater research program and institute for research on drinking water technology, $4 billion for urban water system repair, and the National Water Utility Bank. The EPA set limits of 0.01 mg per liter of total trihalomethanes in drinking water and issued other regulations concerning drinking water quality. The U.S. Water Resources Council published a report on available federal assistance programs for urban water supply systems. Many court cases concerning drinking water are under consideration. Many of these concern pollution of drinking water supplies by chemicals and other hazardous wastes improperly disposed in landfills or discharged into surface waters. (Cassar-FRC)
W81-06175

PERSPECTIVES ON WATER CONSERVATION.
American Society of Civil Engineers, New York. Div. of Water Resources Planning and Management.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR1, p 225-238, March, 1981. 5 Ref.

Descriptors: *Water conservation, *Water management, *Management planning, Municipal water, Water supply, Irrigation, Agriculture, Planning, Water law, Water policy, Education, Water pollution control, Water use efficiency.

Water conservation, one of the objectives of total water management, originally meant conserving spring flood water for use in the dry season. This concept has changed to include efficient use of supplies, water reclamation, and reduction of demand. The many reasons for adoption of water conservation include reduction of energy consumption in water and wastewater treatment, response to opinions of the public, and deferring capital expenditures. Water is a renewable and reusable resource which varies in terms of time, location, quantity, and quality. Conservation projects, whether emergency or normal, should be designed for the specific site, and evaluations based on their economic, social, and environmental benefits and costs. Where to conserve water depends on

the local supply and use. For example, the West uses large quantities of water for irrigation, and the East uses much of its supply for cooling waters at steam electric generating plants. Water conservation may be accomplished by conservation of excess runoff, efficient supply distribution, and demand reduction, management, technology and laws. Examples of conservation measures are increasing water prices, industrial water pollution control, more efficient irrigation practices, reduction of runoff losses, and landscape design to eliminate or reduce watering. In the future, water management must be especially concerned with energy consumption and costs (pumping and cooling). (Cassar-FRC)
W81-06181

COMPENSATING HAZARDOUS WASTE VICTIMS: RCRA INSURANCE REGULATIONS AND A NOT SO SUPER FUND ACT,
Lewis and Clark Coll., OR. Northwestern School of Law.
S. Meyer.
Environmental Law, Vol 11, No 3, p 689-719, Spring, 1981. 154 Ref.

Descriptors: *Legislation, *Insurance, *Hazardous materials, *Waste dumps, Legal aspects, Economic aspects, Toxins, Poisons, Landfills, Compensation, Groundwater pollution.

The Superfund legislation and the Environmental Protection Agency's insurance regulations are analyzed as supplements to the common law compensation system. Superfund established a fund to clean up and restore the environment following a hazardous waste incident. Provisions for victims' compensation for personal injury and property damages were made when EPA promulgated regulations requiring hazardous waste facilities to carry third party liability coverage for harm caused by toxic substances released into the environment. Hazardous wastes often contaminate groundwater and may mix with natural elements in the soil to produce greater toxicity. Incidents of damage to property or human health through groundwater contamination are widespread and costly. In order to fully provide for compensation of victims, the Superfund should be amended; and in addition, federal statutory liability provisions should be enacted to help plaintiffs overcome the obstacles to establishing a common cause of action. (Small-FRC)
W81-06243

PROMISING A PROCESS FOR PARITY: THE PACIFIC NORTHWEST ELECTRIC POWER PLANNING AND CONSERVATION ACT AND ANADROMOUS FISH PROTECTION,
Lewis and Clark Coll., OR. Northwestern School of Law.
M. C. Blumm, and B. L. Johnson.
Environmental Law, Vol 11, No 3, p 497-555, Spring, 1981. 236 Ref.

Descriptors: *Regional planning, *Wildlife conservation, *Legislation, Legal aspects, Anadromous fish, Fish migration, Electric power production, Electric power plants, *Pacific Northwest.

The Pacific Northwest Electric Power Planning and Conservation Act is a comprehensive energy act which will alter the manner in which electric power is supplied to the Pacific Northwest. Major resource acquisitions are to be governed by a regional power planning and conservation plan, to be developed by a new interstate Regional Council. This plan must give first priority to conservation measures, second to renewable resources, third to processes that utilize waste heat, and fourth to other resources such as construction of new coal and nuclear power plants. A comprehensive program must be developed to enhance fish and wildlife resources. Agencies responsible for manipulating river flows and operating dams will have to make necessary operational changes to accommodate minimum survival needs of anadromous fish. This Act is designed to silence the complaint that the costs of accommodating fish and wildlife needs in terms of power and money are just too high. Now, the protection, mitigation of injury, and enhancement of fish and wildlife is a cost of doing business that consumers of electric power will have to bear. (Small-FRC)
W81-06260

ENVIRONMENTAL QUALITY CRITERIA: SOME CONSIDERATIONS,
Environmental Law Inst., Washington, DC.
H. Babich, D. L. Davis, and J. Trauberman.
Environmental Management, Vol 5, No 3, p 191-205, May, 1981. 1 Fig, 8 Tab, 125 Ref.

Descriptors: *Water quality standards, *Microorganisms, *Environmental effects, Aquatic life, Cadmium, Phenol, Toxicity, Ecological dosage, Physiochemical properties, Regulations, Water policy, Microbial degradation, Degradation, Sediments, Standards, Water pollution effects, Ecological effects.

The use of the term, ecological dosage 50% or EcD50, is recommended for the quantification of adverse effects of pollutants on microbe-mediated processes such as biogeochemical cycling, litter decomposition, and mineralization. This information was not considered in EPA's development of water quality criteria. Although few complete studies have been done in this field, a broad S-shaped curve can be plotted for respiration rate vs. concentration of pollutant. EcD50 values could be computed for individual pollutants, environments (such as a soil type), or processes. The advantages of EcD50 over LC50 are: (1) EcD50 from one ecosystem may be correlated with the same process in a different ecosystem, and (2) a given EcD50 value reflects a group of mixed organisms and may be better applied to the total environment. The interactions between pollutant toxicity and abiotic factors justify setting different water quality standards for different regions. These physiochemical factors (such as pH, temperature, aeration state, and many others) affect a pollutant's chemical speciation form, mobility, and bioavailability. Cadmium and phenol are used as examples in the discussion of high risk environments, the partition between water column and sediments, and invisible injury to aquatic life. (Cassar-FRC)
W81-06282

SUBSIDENCE IN HARRIS AND GALVESTON COUNTIES, TEXAS,
Harris-Galveston Coastal Subsidence District, Houston, TX.
For primary bibliographic entry see Field 4B.
W81-06342

SAFETY IN SEWERAGE,
Thames Water Authority, London (England).
J. E. V. Holmes.
Water Services, Vol 84, No 1011, p 299-300, 303-304, May, 1980. 1 Fig.

Descriptors: *Sewerage, *Safety, *Hazards, London, Sewer systems, Rehabilitation, Construction, Engineering, *Personnel management, Training, Legislation.

The requirements of Great Britain's Health and Safety at Work Act (1974) are summarized, with emphasis on the water industry. The director of operations of a water authority and his managers are responsible for providing safe equipment and methods of work; safe arrangements for handling, storage, and transport of materials; safety and health training; safe and healthy workplaces; safe means of access and egress; and adequate welfare facilities. The employees are required to act with due care for themselves and others, follow instructions, use protective equipment when necessary, report any potential safety or health problems, and report any injuries to their supervisors. Contractors and engineers are indirectly responsible for the safety of the water industry workers through designing and building safe structures. They are also directly responsible for their own workmen. In the sewerage field some of the common hazards are hazardous structures, atmospheric pollution, flooding, electrical problems, and rodents. In London, there are about 24,000 km of sewers, most over 75 years old and 18% over 120 years old. Only 5% of these are large enough for man entry. Many sewers are in poor or unknown structural condition, manholes may be too far apart for fast egress, and slating of ladders may be unstable. A program of inspection and rehabilitation of the sewers should be started as a part of the safety program. (Cassar-FRC)
W81-06385

6F. Nonstructural Alternatives

INTERRELATIONSHIPS BETWEEN WATER ALLOCATION AND WATER QUALITY MANAGEMENT POLICIES,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 6D.
W81-06060

STREAMLINED LICENSING OF SMALL-SCALE HYDROELECTRIC PROJECTS IN MASSACHUSETTS,
For primary bibliographic entry see Field 6E.
W81-06118

6G. Ecologic Impact Of Water Development

METHODOLOGIES FOR USE IN PROJECT-RELATED STUDIES,
Fish and Wildlife Service, Fort Collins, CO. Western Energy and Land Use Team.
R. W. Olson.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980, p 157-196. 6 Ref.

Descriptors: *Environmental effects, *Water resources development, *Hydroelectric plants, *Aquatic habitats, Habitats, Fish, Economic aspects, Decision making, Streamflow, Simulation, Distribution, *Ecological effects.

The increasing scarcity of water, power, and wildlife has intensified the conflicts between hydropower development and habitat protection. Two analytical methods for use in water resources project evaluation are the Habitat Evaluation Procedures (HEP) and the Incremental Methodology. The HEP takes a habitat approach to impact assessment and provides a method of quantitatively describing baseline conditions and predicting future habitat conditions in terms of habitat quality and quantity. The procedures consist of two integral parts: habitat evaluations; and monetary evaluations. HEP can be used at various stages in project planning and the data developed can play a significant role in the decisionmaking process. The IGF incremental method allows quantification of the life phases in a given reach of stream, at different streamflow regimes, with different channel configurations and slopes. The incremental approch is composed of five steps: field measurement of channel, physical, and chemical characteristics; hydraulic simulation of the spatial distribution of combinations of depths, velocities, substrate, and cover objects; simulation of the temporal distribution of temperature and chemical constituents; application of habitat evaluation criteria for species and life stages, for each flow regime and channel condition under investigation, and display of the changing habitat usability over time. (Moore-SRC)
W81-06114

EFFECTS OF HYDROELECTRIC PROJECTS ON FISH POPULATIONS,
National Marine Fishery Service, Seattle, WA. Northwest and Alaska Fishery Center.
W. Ebel.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980, p 170-176. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Environmental effects, *Hydroelectric plants, *Reservoirs, *Fish populations, Reser-

voir fisheries, Reservoir operation, Fish management, Anadromous fish, Bass, Water temperature.

There are currently over 1,500 reservoirs in the United States larger than 500 surface acres. Many of the largest of these are formed by hydroelectric dams. The impacts of hydroelectric projects on fish populations are substantially different for watersheds containing mainly warmwater fish than those containing coldwater fish. In general, the overall effect of hydroelectric projects on streams containing warmwater fish is to increase the total population and standing crop, but species composition and abundance are usually changed. Production of warmwater fish, particularly bass, can be substantially enhanced if reservoir level can be optimized during the spawning period of the game fishes. Coldwater fish populations generally decline, particularly if the species are mainly anadromous. The main factors causing the losses are: mortality of juveniles passing through turbines; delay in migration; increased predation; gas bubble disease; and loss of spawning habitat. Solutions to these problems are available for lowhead dams like those constructed in the Columbia River. Coldwater fisheries in reservoirs formed by highhead dams can be continued by periodically stocking from hatcheries if limnological conditions are favorable, but the anadromous portion of the fishery is generally lost upstream from the dam. (Moore-SRC)
W81-06115

HYDROELECTRIC POWER,
Water Resources Council, Washington, DC.
For primary bibliographic entry see Field 6D.
W81-06117

POTENTIAL ENVIRONMENTAL IMPACTS OF HYDROELECTRIC DEVELOPMENT: AN OVERVIEW,
Oak Ridge National Lab., TN.
S. G. Hildebrand.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980, p 322-329. 1 Tab, 6 Fig.

Descriptors: *Hydroelectric plants, *Environmental effects, *Reservoirs, *Dams, Reservoir releases, Flow control, Water level fluctuations, Land use, Water quality, Fish migration, Flow discharge.

Environmental impacts of hydropower facilities arise from: creation of an impoundment; physical presence of a dam; effects of operation of the hydro facility on a reservoir; and effects of operation of the hydro facility on the tailwater or downstream ecosystem. The first environmental issue that arises is land use changes, and the second class of impacts centers around what happens to aquatic ecosystems when water velocity, depth, and travel time are modified. The potential impacts posed simply by the physical presence of a dam on a riverine system include blockage of fish migration and gas supersaturation. The major features of hydroelectric operation that can affect reservoir ecosystems are the amount of water released, and the location of water withdrawal from the reservoir. Water level fluctuation due to hydropower releases can significantly affect reservoir use. The impacts of operation of a hydropower facility on the downstream ecosystem can result from two potential modifications: changes in discharge regime and changes in water quality. Fluctuations in discharge and water level, if extreme, can significantly modify aquatic habitat below a hydropower facility. Several potential water quality considerations in tailwaters resulting from dam-impoundment systems are alteration of temperature regimes, reduced turbidity, changes in dissolved oxygen, increases in dissolved metals, and altered nutrient and organic matter regimes. (Moore-SRC)
W81-06120

ENVIRONMENTAL CONSIDERATIONS IN CORPS PLANNING,
Colorado Univ., Boulder. Dept. of Civil, Environmental and Architectural Engineering.
For primary bibliographic entry see Field 6A.
W81-06180

FACTORS INFLUENCING THE NATURAL REPRODUCTION OF STURGEONS IN THE URAL RIVER,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
V. M. Stygar, and A. G. Tarabrin.
Water Resources (English Translation), Vol 7, No 4, p 379-383, July-August, 1980. 3 Tab, 10 Ref. Translated from Vodnye Resursy, No 4, p 161-166, July-August, 1980.

Descriptors: *Fish reproduction, *Annual runoff, *Sturgeon, Fish management, Fish migration, Fish populations, Fish barriers, Migration, Intakes, *Ural River, Caspian Sea, Runoff, River flow, Predation, USSR.

The magnitude and duration of the spring flood are the main factors influencing the successful reproduction of sturgeons in the Ural River. In years with a runoff less than four cu km per year the time of the young fish's river foraging is shortened by half in comparison with normal years (6-7 cu km per year), the size and weight decrease, and fewer fit young migrate to the Caspian Sea. In addition, dry years cause a concentrated mass migration, making the young fish vulnerable to consumption by other fishes. Smaller sturgeons are also more likely to pass fish screens and enter intake structures. Predatory fish do not consume large quantities of young sturgeon except in dry years. Total losses of young sturgeon from all causes were 7% in 1974, a year of normal 7.6 cu km annual runoff; 93.7 and 95.8% in 1975 and 1977 respectively, with runoffs of 3.56 and 2.95 cu km per year. Corrective measures for this situation involve changes in designs and location of river intakes and limitations on operation during sturgeon migration. It would also be helpful to regulate the abundance of the predatory sheatfish, which live in the river channel during the migration period. (Cassar-FRC)
W81-06312

SUBSIDENCE IN UNITED STATES DUE TO GROUND-WATER WITHDRAWAL,
Geological Survey, Sacramento, CA.
J. F. Poland.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 107, No IR2, p 115-135, June, 1981. 1 Tab, 17 Fig, 24 Ref.

Descriptors: *Subsidence, *Pressure distribution, *Compaction, *Pumpage, *Groundwater storage, Flooding, Soil compaction, Aquifers, Wells, Withdrawal, Surface water, Available water, Economic aspects, Cost analysis, Water supply, Withdrawal, Water treatment.

A casebook prepared by UNESCO is designed to assist engineers in the evaluation of land subsidence in areas of rural America and in developing countries. Seventeen subsidence areas in the United States are identified and described. Subsidence ranges from 0.3 m at Savannah, Georgia, to 9.0 m in the San Joaquin Valley in California. Principal problems caused by subsidence are: (1) differential changes in elevation and gradient of stream channels; (2) failure of well casings due to compaction; (3) tidal encroachment in coastal areas. Subsidence develops under either carbonate substrate overlain by unconsolidated material, such as sinkholes, or in porous semiconsolidated sediments laid down in lacustrine environments. Both types of subsidence occur in the United States. (Titus-FRC)
W81-06338

ECOLOGICAL MONITORING IN THE LUQUILLO FOREST RESERVE,
Tropical Forestry Inst., Rio Piedras (Puerto Rico).
A. E. Lugo, and S. Brown.
Ambio, Vol 10, No 2/3, p 102-107, 1981. 5 Fig, 8 Ref.

Descriptors: *Ecology, *Monitoring, Ecosystems, *Luquillo Forest Reserve, *Puerto Rico, Water supply development, Water quality management, Water supply, Water resources development, Streamflow, Rainfall, Runoff.

Ecological monitoring activities began 100 years ago in the Luquillo Experimental Forest Biosphere Reserve. The reserve comprises 11,300 ha, with elevations from 10 to 1075 meters above sea level. Topography is extremely dissected, with steep upper slopes. The Luquillo Mountains also supply the headwaters for six major rivers which provide water supplies for over 200,000 people. The Forest has been subdivided into five life zones: subtropical wet forest, subtropical rain forest, lower montane wet forest, lower montane rain forest, and the subtropical moist forest life zone. The ecosystems present exhibit strong elevational gradients in both structural and functional characteristics. The discharge of rivers in the reserve is closely coupled to rainfall and is related to elevation. River discharge averages j85% of the rainfall, but at higher elevations river discharge accounts for 95% and at lower elevations for 52% of rainfall. In terms of quality, the waters are cool, neutral pH, and generally oligotrophic. Anions and cations increase in concentration with decreasing elevation. The export of total dissolved solids is linearly related to the discharge of the rivers. Data indicate the effect of abnormally high rainfall years on river discharge. These periods of high rainfall caused increases in the exports of dissolved substances from the forest to other downstream ecosystems. The upper portions of watersheds are protected from intensive uses in order to maximize their usefulness for water quality, yield, and panoramic values and as a refuge for many endemic and rare species. (Baker-FRC)
W81-06376

7. RESOURCES DATA

7A. Network Design

COORDINATED OPERATION OF MID-COLUMBIA RIVER HYDRO PROJECTS,
Dunstan, Inc., Portland, OR.
For primary bibliographic entry see Field 6D.
W81-06112

WATER QUALITY DATA FOR WATER QUALITY DECISIONS,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
W. A. Lyon, and J. S. Hunter.
Water Science and Technology, Vol 13, No 3, p 237-243, 1981.

Descriptors: *Decision making, *Water quality, *Measuring instruments, *Data acquisition, Quality control, Water pollution, Statistical analysis.

Too frequently, policy decisions on water quality are based on inadequate or unsuitable data. This is a special concern to those paying the bill for implementing standards. There are three types of data used for decision making: source data, describing the characteristics of point and nonpoint sources; ambient data, describing the water quality of streams, estuaries, and lakes; and effects data, measurement of the impact of pollutants on aquatic life and structures. Decisions are required regarding water use, the criteria essential to protect the selected uses, nondegradation decisions, characterization of low flows, waste load allocation, stream dynamics, effluent limits, and degree of risk. Much data is of unreliable quality because of measurement problems. The following must be considered to produce data of assured quality: units of measure, method of measurement, calibration, specificity of method, interferences, compatibility, traceability to national reference standards, complexity of method, and sampling strategy. Proper statistical analysis and good quality assurance for the measurements, regardless of geographical location, are also integral parts of obtaining good information upon which to base decisions. (Cassar-FRC)
W81-06159

Group 7A—Network Design

THE BIOSPHERE RESERVE CONCEPT IN THE USSR,
Akademiya Nauk USSR, Moscow. Inst. of Evolutionary Morphology and Animal Ecology.
V. Sokolov.
Ambio, Vol 10, No 2/3, p 97-101, 1981. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Conservation, *Natural resources, *USSR, International agreements, Organizations, Planning, Water conservation, Water resources development, Water supply development, Biosphere reserve.

In the USSR the main focus of the biosphere reserve concept has been on integrated environmental monitoring. Biosphere reserves have been established to act as background stations to discover, through quantitative measurements, how natural and semi-natural ecosystems are responding to various levels of human intervention. Parameters monitored are both ecosystem-specific and universal, the latter including basic meteorological data and pollutants. Pollutants are monitored in the atmosphere; in wet and dry deposition from the atmosphere and in snow cover; in surface and ground water, bottom deposits and suspended matter; and in soil sections and biota, at intervals ranging from daily to once or twice a year. Analysis of these measurements and subsequent modeling will enable people to learn how best to conserve their environment and utilize natural resources on a sustainable basis. A significant achievement of the biosphere reserve concept in the USSR has been the promotion of international cooperation, especially in the field of environmental monitoring, with the USA and with other socialist countries. This has been facilitated by the MAB (Man and the Biosphere) framework, which provides a means for exchanging information, comparisons between similar programs, and standardization of methodologies and equipment on the international level. (Baker-FRC)
W81-06195

7B. Data Acquisition

A METHODOLOGY FOR POINT-TO-AREA RAINFALL FREQUENCY RATIOS,
National Weather Service, Silver Spring, MD. Office of Hydrology.
For primary bibliographic entry see Field 2B.
W81-06129

THE QUANTIFICATION AND RESERVATION OF INSTREAM FLOWS,
Fish and Wildlife Service, Fort Collins, CO.
R. T. Milhous, and W. J. Grenney.
Water Science and Technology, Vol 13, No 3, p 129-154, 1981. 112 Fig, 7 Ref.

Descriptors: *Instream flow, *Water use, *Beneficial use, Legal aspects, Social aspects, Aquatic habitats, Minimum flow, Recreation, Fish management, Wildlife habitats, *Water management, Competing use, Habitats, Water quality, Model studies.

The concept of instream flow as a beneficial use of water has steadily increased since the arid West was first settled. Until recently, agriculture and mining were considered more important than fish and wildlife. Some western states have legislation to provide for minimum base flows and water quality standards for wildlife, fish, scenic, esthetic, and navigational uses. Beneficial uses of instream water and their flow requirements are discussed--fish, wildlife, esthetics, water-based recreation, navigation, waste transport, hydroelectric power, and social values. Conflicts between fish production and water recreation are presented. The Physical Habitat Simulation System has been developed to evaluate alternatives for fish and recreation management. This model may be combined with the Stream Simulation and Assessment Model and the Dynamic Dissolved Oxygen Temperature Model to predict water quality. (Cassar-FRC)
W81-06149

DESIGN HYETOGRAPHS FOR SMALL DRAINAGE STRUCTURES,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. C. Yen, and V. T. Chow.
Journal of the Hydraulics Division, Proceedings of the American society of Civil Engineers, Vol 106, No HY6, p 1055-1076, June, 1980. 9 Fig, 5 Tab, 23 Ref.

Descriptors: *Hyetographs, *Drainage systems, *Storm water, Storm water runoff, Runoff, Flooding, Graphical analysis, Mathematical studies.

The feasibility of using a simple triangular hyetograph to represent approximately the geometry of local rainstorm hyetographs for the design of small storm drainage systems was investigated. The major parameters describing the rainstorm temporal patterns were statistically analyzed. A triangular representation of the hyetograph can be established by using only the first moment. The resulting dimensionless hyetographs are nearly identical when they are nondimensionalized using the rainfall depth and duration. They show some seasonal effect for heavy rainstorms and insignificant effects due to rainfall duration. The use of the hyetograph is simple, and can help in the design of drainage facilities for small drainage areas by indicating the time distribution of rainfall. The feasibility and accuracy of using the first and second time moments to approximate design hyetographs should be explored. (Small-FRC)
W81-06204

AUTOMATIC RAW WATER QUALITY MONITORING STATIONS AT MORSANG/SEINE (LA SURVEILLANCE AUTOMATIQUE DE LA QUALITE DE L'EAU BRUTE).
For primary bibliographic entry see Field 5F.
W81-06254

LITHODYNAMICS OF NORTH SIBERIAN RIVER DELTAS,
Moscow State Univ. (USSR).
V. N. Korotaev, A. Yu. Sidorchuk, and R. S. Chalov.
Water Resources (English Translation), Vol 7, No 1, p 51-57, January/February, 1980. 16 Ref. Translated from Vodnye Resursy, No 1, p 138-145, January/February, 1980

Descriptors: *Lithification, *Deltas, Rivers, *Siberia, Forecasting, Sedimentation, Mapping, Aerial photography, Geomorphology, Hydrology, Channels.

A study of lithodynamic processes was undertaken in river deltas of northern Siberia to aid in efforts to forecast changes in the relief under the effect of natural factors and planned water-management undertakings. Geomorphological mapping, dating of deposits by means of radiocarbon and spore-pollen analyses, and a comparison of source maps made it possible to reveal the main features of development of the deltas and dynamics of the drainage network during the Holocene. A comparison of channel surveys and aerial photographs taken at different times gave information on the dynamics of channel formations of delta distributaries and river-mouth and marine bars during the past 50 years. The stream-gauging data and analysis of soil surveys made it possible to estimate the balance of sediments in the deltas and their parts and determine the trend of development of distributaries. The total data was used as the basis for forecasting the future development of deltas and channel deformations within them. The development of the deltas of the Danube, Terek, Sulak, Kuban, and Don Rivers is described as passing through a scheme of stagewise processes. The scheme is founded on the idea of a river delta passing through stages of formation: first filling of the bay and lagoon, then progradation beyond the line of the blocking bar and accumulation of a pioneer delta. A distinctive characteristic of the lithodynamic delta-forming processes in northern Siberia is their small average rate of progress. (Baker-FRC)
W81-06291

USE OF SATELLITE PHOTOGRAPHY IN STUDIES OF INLAND WATER BODIES AND RIVER MOUTHS,
Akademiya Nauk USSR, Moscow. Inst. Vodnykh Problem.
G. F. Krasnozhon, V. P. Saltankin, and S. S. Semenov.
Water Resources (English Translation), Vol 7, No 1, p 39-51, January/February, 1980. 3 Tab, 13 Ref. Translated from Vodnye Resursy, No 1, p 121-137, January/February, 1980.

Descriptors: *Remote sensing, *Satellite technology, Rivers, Deltas, Lakes, Shores, Shoreline cover, Morphology, Hydrology, Alluvial rivers, Sediments, Drainage.

The use of satellite photography to investigate water resources is discussed. Satellite information can be used to study the physiographic, morphological, hydrological, hydrobiological, and anthropogenic parameters and characteristics of water objects. The organization of the efforts and the processing of aerial and satellite images are discussed. The main principles of the method of satellite photography are discussed in relation to the North Caspian and its river-mouth regions. The following natural units were detected and interrelated: boundaries of natural objects, drainage networks, alluvial delta zona and adjacent territories, kultuk zone, delta front, and open coastal waters. The identification of each of these natural objects on satellite photographs is described. (Baker-FRC)
W81-06292

INVESTIGATION OF THE ORIGIN AND DYNAMICS OF WATERS OF LARGE LAKE BASINS BY MEANS OF NATURAL ISOTOPES,
Akademiya Nauk USSR. Moscow. Inst. Vodnykh Problem.
V. S. Brezgunov, V. V. Nechaev, V. V. Romanov, and V. I. Ferronskii.
Water Resources (English Translation), Vol 7, No 1, p 29-38, January/February, 1980. 6 Fig, 9 Tab, 9 Ref. Translated from Vodnye Resursy, No 1, p 108-120, January/February, 1980

Descriptors: *Lakes, *Hydrology, Isotope studies, Tritium, Oxygen, Evaporation, Lake Issyk-Kul, USSR, Hydrologic cycle.

Water cycle conditions were investigated in the basin of the closed mountain lake Issyk-Kul, based on data on the distribution of oxygen-18 and tritium in natural waters of the Issyk-Kul Basin and the results of using tritium for studying water column dynamics in the northern part of Lake Baikal. The lake fills a deep intermontane basin and is a convenient subject for studying fractionation of stable hydrogen and oxygen isotopes during the hydrologic cycle. Intense evaporation enriches the lake waters in heavy isotopes. Samples of lake and river waters and precipitation were taken during 1974-1977 in the Issyk-Kul Basin. The oxygen isotope composition of the water column of the lake was quite homogeneous. The precipitation of oxygen-18 in the central part of the basin substantially exceeded the corresponding values in the eastern region, which indicates the predominance of moisture circulation conditions in which the local water cycle occurs most intensely in the central part of the Issyk-Kul basin. In tritium studies, the considerable uniformity of the distribution of tritium in the water masses of the lake, its high level in the bottom layers of water, and the passage of the water temperature twice a year below the temperature of maximum density make it possible to use a 'box' model for determining the water-exchange time of the lake. It was concluded that the results of the investigations using natural isotopes to study the water cycle in the basin and dynamics of the water masses of Lake Baikal indicated sufficient effectiveness for the method employed. (Baker-FRC)
W81-06293

SUITABILITY FOR SEPTIC TANK FILTER FIELDS AND TAXONOMIC COMPOSITION OF THREE SOIL MAPPING UNITS IN ARKANSAS,
Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W81-06319

U.S. GEOLOGICAL SURVEY - THE OTHER WATER QUALITY AGENCY,
J. Dale.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 650-655, April, 1980. 2 Tab.

Descriptors: *Geological surveys, *Water quality, *Data collections, Federal jurisdiction, Data acquisition, Groundwater pollution, Monitoring, *Available water.

Seventy percent of the water data produced by the federal government is generated by the U.S. Geological Survey (USGS). The data include 90% of the stream flow data and 50% of the water quality data. USGS is not an enforcement agency but it determines what U.S. water quality is and how much U.S. water there is. The agency oversees national water quality/quantity monitoring networks, river basin studies, and remote sensing studies of atmospheric water quality as well as of groundwater and marine water quality. The agency is also involved in urban runoff studies, aquatic biology sampling, radioactive waste disposal studies, and acid rain studies. USGS data holdings and data indices include the National Water Data Storage and Retrieval System (WATSTORE) and the National Water Data Exchange (NAWDEX). (Small-FRC)
W81-06329

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1980--VOLUME 3. WESTERN NEW YORK.
Geological Survey, Albany, NY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-227316. Price codes: A12 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NY-80-3, 1981. 247 p, 5 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *New York, Western New York.

Water resources data for the 1980 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 83 gaging stations, stage only at 14 gaging stations, stage and contents at 6 gaging stations, and 2 other lakes and reservoirs, water quality at 19 gaging stations, 5 quality of precipitation stations, and water levels at 19 observation wells. Also included are data for 52 crest-stage and 16 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 1 and 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in New York. (USGS)
W81-06078

WATER RESOURCES DATA FOR MAINE, WATER YEAR 1980.
Geological Survey, Augusta, ME. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-226789, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report ME-80-1, 1981. 228 p, 3 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Maine.

Water resources data for the 1980 water year for Maine consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of wells. This report contains discharge records for 61 gaging stations, stage only for 2 gaging stations, contents for 17 lakes and reservoirs, water quality for 14 gaging stations and 12 wells, and water levels for 23 observation wells. Additional water data collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies. (USGS)
W81-06079

WATER RESOURCES DATA FOR IDAHO, WATER YEAR 1980--VOLUME 1. GREAT BASIN AND SNAKE RIVER BASIN ABOVE KING HILL.
Geological Survey, Boise, ID. Water Resources Div.
Geological Survey Water-Data Report ID-80-1, June, 1981. 378 p, 12 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Idaho, *Great Basin, Snake River basin.

Water resources data for the 1980 water year for Idaho consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report in two volumes contains discharge records for 192 gaging stations; stage only records for 2 gaging stations; stage only for 11 lakes and reservoirs; contents only for 16 lakes and reservoirs; water quality for 85 gaging stations, 43 partial-record stations, 196 wells, and 5 precipitation sites; and water levels for 366 observation wells. Also included are data for 56 crest-stage partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (USGS)
W81-06080

WATER RESOURCES DATA FOR IDAHO, WATER YEAR 1980--VOLUME 2. UPPER COLUMBIA RIVER BASIN AND SNAKE RIVER BASIN BELOW KING HILL.
Geological Survey, Boise, ID. Water Resources Div.
Geological Survey Water-Data Report ID-80-2, June, 1981. 380 p, 22 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Idaho, *Upper Columbia River basin, Snake River basin.

Water resources data for the 1980 water year for Idaho consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report in two volumes contains discharge records for 192 gaging stations; stage only records for 2 gaging stations; stage only for 11 lakes and reservoirs; contents only for 16 lakes and reservoirs; water quality for 85 gaging stations, 43 partial-record stations, 196 wells, and 5 precipitation sites; and water levels for 366 observations wells. Also included are data for 56 crest-stage partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (USGS)
W81-06081

WATER RESOURCES DATA FOR VIRGINIA, WATER YEAR 1980.
Geological Survey, Richmond, VA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-113416, Price codes: $42.00 in paper copy, A01 in microfiche. Geological Survey Water-Data Report VA-80-1, June, 1981. 597 p, 4 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment-transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Virginia.

Water resources data for the 1980 water year for Virginia consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 210 gaging stations, stage only at 1 gaging station, stage and contents at 10 lakes and reservoirs, water quality at 53 gaging stations and 120 wells, and water levels at 60 observation wells. Also included are data for 63 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program. Discharge measurements were made at 142 coal-monitoring partial-record stations and at 67 low-flow partial-record stations. Miscellaneous data were collected at 311 measuring sites and 186 water-quality sampling sites. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia. (USGS)
W81-06082

WATER RESOURCES DATA FOR WISCONSIN, WATER YEAR 1980.
Geological Survey, Madison, WI. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-235186, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WI-80-1, May, 1981. 505 p, 5 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Wisconsin.

Water-resources data for the 1980 water year for Wisconsin include records of streamflow at gaging stations, partial-record stations, and miscellaneous sites; records of reservoir storage; records of chemical, physical, and biological characteristics of surface water, ground water, and precipitation; and records of water levels in observation wells. Records for a few gaging stations in bordering States also are included. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Wisconsin. (USGS)
W81-06083

WATER RESOURCES DATA FOR NORTH DAKOTA, WATER YEAR 1980.
Geological Survey, Bismarck, ND. Water Resources Div.
Geological Survey Water-Data Report ND-80-1, May, 1981. 803 p, 6 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport,

Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *North Dakota.

Water resources data for the 1980 water year for North Dakota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 144 gaging stations; stage only records for 22 gaging stations; stage and contents for 13 lakes and reservoirs; water quality for 87 gaging stations, 33 partial-record stations, 39 lakes, and 80 wells, and water levels for 32 observation wells. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in North Dakota. (USGS)
W81-06084

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1980--VOLUME 1. NORTHEAST FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
Geological Survey Water-Data Report FL-80-1, 1981. 532 p, 34 Fig, 1 Tab, 11 Ref.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Florida, *Northeast Florida.

Water resources data for the 1980 water year in northeast Florida include continuous or daily discharge for 55 streams; periodic discharge for 4 streams; peak discharge for 32 streams; continuous or daily stage for 24 streams and periodic stage for 3 streams; continuous elevations for 23 lakes and periodic elevations for 28 lakes; continuous ground-water levels for 29 wells, periodic groundwater levels for 118 wells, and miscellaneous water-level measurements for 855 wells; and quality of water for 29 surface-water sites and for 205 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (USGS)
W81-06085

WATER RESOURCES DATA FOR OREGON, WATER YEAR 1979.
Geological Survey, Portland, OR. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-226771, Price codes: $50.00 in paper copy, A01 in microfiche. Geological Survey, Water-Data Report OR-79-1, 1981. 743 p, 5 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Oregon.

Water resources data for the 1979 water year for Oregon consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This reports contains discharge records for 278 gaging stations, stage only records for 10 gaging stations, stage and contents for 43 lakes and reservoirs, water quality for 85 gaging stations, and water levels for 81 observation wells. Also included are 95 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by U.S. Geological Survey and cooperating State and Federal agencies in Oregon. (USGS)
W81-06086

WATER RESOURCES DATA FOR NEBRASKA, WATER YEAR 1980.
Geological Survey, Lincoln, NE. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-100926, Price codes: A21 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NE-80-1, 1981. 471 p, 6 Fig, 5 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Nebraska.

Water resources data for the 1980 water year for Nebraska consist of both surface water and ground water. This report contains water-discharge records for 158 streamflow-gaging stations, 53 partial-record or miscellaneous streamflow stations, and 5 crest-stage, partial-record streamflow stations; stage and content records for 10 lakes and reservoirs; water-quality records for 58 streamflow stations, 44 ungaged streamsites, and 192 wells; and water-level records for 60 observation wells. Additional water-discharge data were collected at various sites, not part of the systematic data-collection program, to determine surface-water/groundwater relationships and are published under low-flow investigations. These data represent that part of the National Water-Data System operated by the U.S. Geological Survey and cooperating State and Federal Agencies in Nebraska. (USGS)
W81-06102

WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1980--VOLUME 1. ATLANTIC SLOPE BASINS, HUDSON RIVER TO CAPE MAY,
Geological Survey, Trenton, NJ. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-102112, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NJ-80-1, 1981. 362 p, 7 Fig, 3 Tab, 36 Ref.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *New Jersey, *Atlantic slope basins, Hudson River.

Water resources data for the 1980 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This volume of the report contains discharge records for 75 gaging stations; tide summaries for one (1) station; stage and contents for 15 lakes and reservoirs; water quality for 84 surface-water sites and 108 wells; and water levels for 34 observation wells. Also included are data for 43 crest-stage partial-record stations, 22 tidal crest-stage gages, and 47 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (USGS)
W81-06103

WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR 1980--VOLUME 2. DELAWARE RIVER BASIN AND TRIBUTARIES TO DELAWARE BAY.
Geological Survey, Trenton, NJ. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-102120, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Data Report NJ-80-2, 1981. 287 p, 7 Fig, 3 Tab, 36 Ref.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *New Jersey, Delaware River basin, *Delaware Bay tributaries.

Water resources data for the 1980 water year for New Jersey consist of records of stage, discharge, and water quality of streams; contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This volume of the report contains discharge records for 27 gaging stations; tide summaries for 3 stations; stage and contents for 16 lakes and reservoirs; water quality for 59 surface-water sites and 95 wells; and water levels for 16 observation wells. Also included are data for 27 crest-stage partial-record stations, 7 tidal crest-stage gages, and 19 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by U.S. Geological Survey and cooperating State and Federal agencies in New Jersey. (USGS)
W81-06104

8. ENGINEERING WORKS

8A. Structures

TESTING AND EXAMINATION OF CONCRETE CORES - MINIDOKA DAM, IDAHO,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. J. Bard, J. Trojanowski, and C. A. Bechtold.
Report GR-80-8, December, 1980. 27 p, 10 Fig, 4 Tab, 2 Ref.

Descriptors: *Concrete dams, *Concrete testing, *Physical properties, *Cracks, Spillays, Maintenance, Compressive strength, Elastic properties, Density, Strength, Shear tests, Deterioration, Petrography, *Minidoka Dam, Idaho.

Proposed modifications at Minidoka Dam prompted physical properties tests on 150-mm diameter cores which were extracted between October 18 and November 14, 1977. In 1929, a shear crack, caused by a thawing ice sheet, developed in the overflow spillway and the danger of cracking in the spillway remains a concern. Repairs were performed, but the displaced crest was not moved back into place. There apparently has been little or no differential movement since the repairs. Compressive strength tests indicate the strength is significantly higher than the probable design strength. Elasticity test results show a large variation in the moduli of elasticity and Poisson's ratio, probably due to volcanic stone in the concrete. Absorption varied from 2.7 to 6.1%. There was little variation in density and a wide variation in tensile strength. The average shear strength at normal load was 3.0 MPa and seemed reasonably high through intact construction joints. Alkali-silica reaction is the main chemical deterioration observed in this concrete. Petrographic evidence and physical properties indicate large variability in concrete quality. (Brambley-SRC)
W81-06105

UNDERGROUND PUMPED STORAGE,
Acres American, Inc., Buffalo, NY.
D. C. Willett.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980. p 73-82, 6 Fig, 2 Tab.

Descriptors: *Pumped storage, *Hydroelectric plants, *Feasibility studies, Pump turbines, Economic aspects, *Underground storage, *Reservoirs, Turbines, Tunnels, Caverns.

Because of the economic and environmental problems associated with conventional pumped storage, consideration has been given to the possibility of

underground pumped storage. Instead of having both reservoirs located at the surface, the upper reservoir is at ground level and the lower reservoir is located in a cavern at some depth below ground level to allow generation and pumping utilizing the head between the two reservoirs. This leaves only one reservoir on the surface, but requires the excavation of a cavern of a fairly significant size at some depth below the ground surface. Single-stage reversible pump-turbine units limit head to the neighborhood of 2,000 ft. An alternative concept is to develop a total head of 4,000 ft by providing an intermediate power plant to operate at 2,000 ft and another plant to operate at a depth of 2,000 ft under that. The possibility does exist of the development of the full head in one step without the intermediate power plant. The feasibility of the use of multi-stage reversible pump turbines is being examined in this regard. These multiple-stage pumps can be operated in the reverse direction at remarkably high efficiencies to allow efficient operation at heads in the region of about 3,000 ft. The lower reservoir for these undeground pumped storage project will consist essentially of a series of parallel large tunnels. The lower reservoir tunnel currently being examined is 60 ft wide, 85 ft high: 20,000 ft length of tunnel will be needed in order to provide about 10,000 megawatt hours of storage at 5,000 ft. (Moore-SRC)
W81-06110

MODERNIZATION OF HYDROELECTRIC UNITS,
Allis-Chalmers Corp., York, PA. Hydro-Turbine Div.
G. F. Wachter.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980, p 83-96. 6 Fig, 2 Tab, 1 Ref.

Descriptors: *Hydroelectric plants, *Turbines, *Economic feasibility, *Dams, Electrical equipment, Water resources development, River flow, Reservoirs, Peaking capacity, Performance evaluation, Performance upgrading.

There are many existing hydroelectric stations operating below their potential capability. The hydraulic units do not develop the maximum contribution to power systems they are serving. Their rated capacities may have been selected without allowances for changes that have occurred such as closer regulation of the river flow due to storage reservoirs, new plants located either upstream or downstream, changes in peaking capacity value, and possibly other factors which today are evaluated in a modern hydroplant study. Modern runner designs and turbine arrangements have been developed to permit additional ways of upgrading the performance of the older generating units. Abandoned hydrogenerating installations considered uneconomical for rehabilitation or modernization previously, are now being studied to utilize the available water resources. Recent studies of existing dams in Northeast indicate that 10 to 20% of existing dams deserve a more serious look towards modernization or installation of new hydrogenerating units. Several existing installations have been modernized and uprated in recent years. A review of a number of these installations provides an interesting documentation of improvement in the performance of the modern hydraulic turbines as compared to the original unit. (Moore-SRC)
W81-06111

LOW-HEAD HYDROELECTRIC UNIT FUNDAMENTALS,
Allis-Chalmers, York, PA. Hydro Turbine Div.
For primary bibliographic entry see Field 8C.
W81-06119

CAVITATION DAMAGE TO HYDRAULIC STRUCTURES,
Colorado State Univ., Fort Collins. Engineering Research Center.
W. J. Rahmeyer.
Journal of the American Water Works Association, Vol. 73, No. 5, p 270-274, May, 1981. 1 Fig, 29 Ref.

Descriptors: *Cavitation, *Hydraulic structures, *Damage, Water pressure, Flow, Fluid dynamics, Flow velocity, Noise, Vibrations, Design criteria.

The different types, causes, and mechanics of cavitation are discussed, and methods for preventing cavitation damage to structures are explored. During cavitation small bubbles of vapor or gas expand and collapse. The collapse produces noise and can cause vibration damage to nearby materials. Four common effects of cavitation are noise, vibration, damage, and flow modification. Damage usually occurs in areas of high flow velocities or low pressure areas. A separation zone or two-phase flow in the presence of a high velocity provides the conditions necessary for damage. Structures that can suffer damage include valves, gates, impellers, entrances, exists, crests, gate slots, spillways, energy dissipators, and structures with surface irregularities. Damage can be eliminated by streamlining and removing irregularities from flow surfaces. Also, reducing velocities and increasing ambient and local pressures can prevent damage. Careful design and construction to prevent conditions that favor cavitation and cavitation damage are important. (Small-FRC)
W81-06166

MULTI-STAGE OUTLET DESIGN OF STORM-WATER RETENTION FACILITIES,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
D. W. Lafleur, and E. A. McBean.
Canadian Water Resources Journal, Vol 6, No 1, p 25-50, 1981. 8 Fig, 1 Tab, 22 Ref.

Descriptors: *Storm runoff, *Detention reservoirs, *Design criteria, Storm water, Urban runoff, Mathematical equations, Outlets, Flow rates, Mathematical models, Canada.

Increased urbanization in Canada has resulted in the development of stormwater retention facilities in many areas which were previously rural. A survey of consulting engineering companies involved in the design of urban drainage works was conducted to determine current strategies used in the design of stormwater retention facilities and to evaluate the effectiveness of these design strategies in meeting stated runoff quantity objectives. The survey results indicated that the design strategies used were inadequate to meet design objectives. Model simulations showed that the practice of designing the principle outlet to release at a constant rate, usually corresponding to the peak predevelopment flow level of a storm of specific return period, did not meet peak predevelopment flow rates and functioned very poorly when subjected to storms other than the design storm. A multi-stage outlet can be designed using peak predevelopment flow rates of both a high and a low frequency event in order to satisfy the design objectives of a broader range of conditions. Simulations of the performance of such an outlet when subjected to 5, 10, and 25 year storms demonstrated that the outlet is capable of meeting two of the three design flows exactly. These results were found with both trapezoidal weir outlets and closed drop inlet spillways. (Carroll-FRC)
W81-06266

8B. Hydraulics

COMMON PIPE FLOW FORMULAS COMPARED WITH THE THEORY OF ROUGHNESS,
East Worcestershire Waterworks Co., Bromsgrove (England).
P. A. Lamont.
Journal of the American Water Works Association, Vol 73, No 5, p 274-280, May, 1981. 5 Fig, 4 Tab.

Descriptors: *Pipe flow, *Hydraulic roughness, *Roughness coefficient, Mathematical studies, Hydraulic friction, Mathematical equations, Pipes, Conveyance structures.

The theory of roughness is reviewed, and the test results on which the recommended roughness values were based are described. A table is presented of recommended values of the Hazen-Williams coefficient C, which is a popular formula in the United States. Results obtained from Colebrook and Moody formulas based on the theory of roughness agree with those obtained from the Hazen-Williams and Scobey exponential formulas. At extreme velocities, the correspondence would not necessarily be close, and the Colebrook and Moody formulas would be more reliable. Formulas are presented which can be evaluated without difficulty on a calculator with 'log' and 'y to the x' keys. The results are applicable to the pipe, whether carrying water, other fluids, or gases. The mean experimental values and the recommended design values of the equivalent surface roughness for various types of new pipe are summarized. (Small-FRC)
W81-06156

CAVITATION DAMAGE TO HYDRAULIC STRUCTURES,
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 8A.
W81-06166

A SIMPLE TECHNIQUE FOR THE ANALYSIS OF FREE SURFACE FLOW PROBLEMS,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Civil Engineering and Building Technology.
P. W. France.
Advances in Water Resources, Vol 4, No 1, p 20-22, March, 1981. 4 Fig, 7 Ref.

Descriptors: *Water boundary, *Surface flow, *Finite element method, Flow, Mathematical studies, Equations.

A simple technique for locating the free boundary was developed to aid in the solution of free surface flow problems. Using this technique, all elements remain fixed in space but with the upper boundary passing through them. This technique avoids recomputation of the element characteristics during the iterative procedure, which can reduce computation time and, therefore, computer costs. Using conventional methods, it is necessary to derive the element characteristics for the entire discretized domain to reflect the successive changes in the element geometry. The simple technique is illustrated using linear quadrilateral elements with two nodes along each element boundary. The method, however, is also applicable for higher order elements. (Small-FRC)
W81-06177

LABORATORY STUDY OF HYDRAULIC FRACTURING,
New Hamphire Univ., Durham. Dept. of Civil Engineering.
G. W. Jaworski, J. M. Duncan, and H. B. Seed.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No GT6, p 713-732, June, 1981. 12 Fig, 2 Tab, 15 Ref.

Descriptors: *Dam failure, *Hydraulic fracturing, *Boreholes, Experimental data, Cracks, Water pressure, Earth dams, Wetting, Strength, Tensile stress.

Investigations were performed to obtain an improved understanding of the mechanics of hydraulic fracturing around boreholes, to clarify the role of some of the factors which affect the water pressure at which hydraulic fracturing can occur, and to attempt to relate the results of borehole fracturing tests to conditions which may promote hydraulic fracturing in the cores of embankment dams. Results indicated that hydraulic fracturing is promoted by or may require a borehole, an existing crack, or loose soil adjacent to a rock joint within which water pressure can develop tensile stresses through a wedging action in the soil. Hydraulic separation can occur at an interface between soil and a dissimilar material such as concrete or rock as soon as the water pressure reaches the same magnitude as the normal stress across the interface.

It seems that the effective stress must become tensile and equal in magnitude to the tensile strength of the soil. Hydraulic fracturing may occur in a borehole because of the wetting action of the water acting upon the walls of the hole or the wetted zone around the hole. (Small-FRC)
W81-06205

OPTIMAL DESIGN OF GRAVITY FLOW WATER CONDUITS,
Universidad Nacional Autonoma de Mexico, Mexico City. Dept. of Civil Engineering.
R. Canales-Ruiz.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 106, No HY9, p 1489-1502, September, 1980. 9 Fig, 8 Ref.

Descriptors: *Conduits, *Gravity flow, *Design criteria, Flow, Optimal yield, *Aqueducts, Optimization, Systems analysis.

The standard methods used for the optimal design of aqueducts can only be applied to cases where the slope of the grade line can be changed continuously. Even then it is necessary to choose some points where the head value is assumed to be known. Although dynamic programming can be an alternative method of solution to the problem, two aspects must be considered. First, since the control variables (diameters) are discrete and do not necessarily produce integer related state variable changes, it is necessary to make modifications to the standard dynamic programming formulation. Second, the points at which the changes of the diameters are allowed should be given. The design problem can also be solved through linear programming, but the size of the problem may become very large. With the method proposed it is unnecessary to specify the control points, and the points where the diameters should change are given directly by optimality conditions. This method, besides being easily implemented in a digital computer, has a graphical interpretation very appropriate for the solution of design problems. The Maximum Principle with minor changes can also be used to solve other design problems, including those concerned with pumping cost and pipe costs. (Baker-FRC)
W81-06206

THE RAINSTORM WHICH CAUSED THE MORVI DAM DISASTER IN AUGUST 1979,
Institute of Tropical Meteorology, Poona (India).
O. N. Dhar, P. R. Rakhecha, B. N. Mandal, and R. B. Sangam.
Hydrological Sciences Bulletin, Vol 26, No 1, p 71-81, March, 1981. 7 Fig, 6 Tab, 13 Ref.

Descriptors: *Dam failure, *Rainstorms, *Rainfall intensity, Earth dams, Depth-area-duration analysis, Storms, Disasters, Morvi dam, *India.

The heavy rainfall that caused the Machhu dam failure and the resulting 8-10 m flood wave was analyzed by depth-area-duration and depth-duration methods. The storm on August 11, 1979, caused the earth dam to collapse, and the flash flood entirely submerged Morvi and nearby villages (India). Rainfall data for 80 years was examined, and there were instances when stations in the region received their respective mean annual rainfall in a single day. The maximum 1-day rainfall varied from 180 to 510 mm and 2-day from 330 to 680 mm. During the two days preceding the collapse of the dam, the Macchu basin received about four times the normal basin rainfall for August. The large volume of water generated during the rainstorm of August 1979 (three-day depth 447 mm) was mainly due to the condition of moderate to heavy rainfall which prevailed in the basin during the ten days before the dam failure. Depth-area-duration analysis of past severe rainstorms found that a 1927 storm, which did not cause dam failure, was much more severe than the August 1979 storm. (Small-FRC)
W81-06354

8C. Hydraulic Machinery

LOW-HEAD HYDROELECTRIC UNIT FUNDAMENTALS,
Allis-Chalmers, York, PA. Hydro Turbine Div.
H. A. Mayo, Jr.
In: Hydropower: A National Energy Resource, Proceedings, Easton, Maryland, March 11-16, 1979. Institute for Water Resources, Army Corps of Engineers, Fort Belvoir, Virginia, 1980, p 291-321. 17 Fig.

Descriptors: *Low head, *Hydroelectric plants, *Turbines, *Economic feasibility, Dams, Stream discharge, Feasibility studies, Cost-benefit analysis.

The development of thousands of existing low head dams is once again becoming economical as nonrenewable energy resources are rapidly increasing in cost. For almost two generations the development of low-head hydroelectric sites has been all but stopped, so that few people are familiar with the basic technology and background. Rules of thumb can provide a starting place for sizing equipment. It is known from experience that average rainfall information is directly related to the streamflow based on the drainage area at a particular site. This can provide a starting place for sizing the turbine on a preliminary basis. If there are existing structures, the sizing of an individual turbine may be determined by the width of an existing tailrace or the area of the tailrace outlet. Rules of thumb and simplified calculations help to provide a quick and economical estimate of a sites potential. With such information and a basic knowledge of equipment alternatives as well as approximate costs, an initial approximation of site feasibility may be developed. Factors to be considered in low-head development include: setting, open flume versus pressure case, intakes, draft tubes, impulse runners, reaction runners, distributors, and generators. The challenge facing developers of low-head hydroelectric sites is to find means to reduce project costs so that the lower-capacity and lower-head hydroelectric sites will be economical. A fundamental approach to lower-cost projects is standardization. (Moore-SRC)
W81-06119

8D. Soil Mechanics

SOIL FAILURE MODES IN UNDRAINED CYCLIC LOADING,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
E. T. Selig, and C. S. Chang.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 107, No GT5, p 539-551, May, 1981. 16 Fig, 8 Ref.

Descriptors: *Soils, *Strain, Shear tests, Shear stress, Strength, Soil properties, Soil mechanics, Pressure distribution, *Saturated soils.

The two major different categories of cyclic triaxial tests are illustrated to define soil failure modes. In a cyclic triaxial test, failure can be defined by a specified magnitude of strain developed within the sample. In one type of failure mode the permanent axial strain reaches the specified value first, and in the other type the cyclic strain reaches the specified value first. Shear stress reversal was the governing factor which distinguished these two modes. When no shear stress reversal occurred, the permanent strain failure mode was the governing factor. The largest pore pressure increase involved the condition of shear stress reversal. Only in the case of shear stress reversal can 100% pore pressure ratio and thus zero effective stress occur. However, the condition of shear stress reversal or no reversal was directly associated with the condition of whether or not the cyclic deviator stress was greater than the static deviator stress. When the cyclic deviator stress was greater than the static deviator stress, cyclic strain governed failure, and shear stress reversal occurred. While the same magnitude of strain can be used to define failure, whether the mode of failure is cyclic or permanent strain, these two modes are quite different and cannot be treated as interchangeable. (Baker-FRC)
W81-06229

8F. Concrete

TESTING AND EXAMINATION OF CONCRETE CORES - MINIDOKA DAM, IDAHO,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8A.
W81-06105

8G. Materials

SURVEY OF SERVICE BEHAVIOR OF LARGE EVAPORATIVE DESALTING PLANTS,
Little (Arthur D.), Inc., Cambridge, MA.
For primary bibliographic entry see Field 3A.
W81-06051

PROTECTING THE INSTALLATION - AND THE POPULATION; EPOXY, POLYURETHANE AND EPDM MATERIALS IN THE PUBLIC UTILITIES.
Water Services, Vol 85, No 1020, p 73-74, 77, February, 1981. 3 Fig.

Descriptors: *Coatings, *Materials engineering, Linings, Reservoirs, Pipes, Sewers, Epoxy resins, Binders, Sealants.

Coatings based on epoxides, polyurethanes, polyesters and fluorocarbons, if correctly applied, will give corrosion protection of pipes, tunnels, stormwater outflows and other structures for 10-20 years on iron, steel or concrete wherever aggressive conditions are experienced. Seals can be provided for movement joints of all types. Water loss from a 20 M liter service reservoir, running at about 270,000 liter, was reduced to an acceptable level by the installation of a pre-formed Neoferma epdm synthetic rubber gasket to reseal the original construction joints on the water face, which had failed due to bacterial degradation. A 50-yr old octagonal RC water tower was leaking when filled to TWL. Large cracks in the walls and floor of the 227 cubic meter capacity tank and an asphalt lining that was damaged beyond repair were the problems. A coat of Colebrand CXL 230 epoxy resin primer was applied by airless spray over the walls and floor after they had been properly prepared. Examples are also provided of cases of re-lining a brickwork sewer, modifications of a standard leak sealing material, and the provision of external protection for pipes and roof repairs. (Baker-FRC)
W81-06172

PERSISTENCE OF THREE ORGANOPHOSPHORUS INSECTICIDES IN ARTIFICIAL PONDS AND SOME BIOLOGICAL IMPLICATIONS,
York Univ., Downsview (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W81-06257

8I. Fisheries Engineering

PROMISING A PROCESS FOR PARITY: THE PACIFIC NORTHWEST ELECTRIC POWER PLANNING AND CONSERVATION ACT AND ANADROMOUS FISH PROTECTION,
Lewis and Clark Coll., OR. Northwestern School of Law.
For primary bibliographic entry see Field 6E.
W81-06260

IMPORTANCE OF THE WATER-LEVEL REGIME FOR RESERVOIR FISHERY,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 2H.
W81-06301

FACTORS INFLUENCING THE NATURAL REPRODUCTION OF STURGEONS IN THE URAL RIVER,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
For primary bibliographic entry see Field 6G.
W81-06312

LOUVERED OFFSHORE INTAKE FOR DIVERTING FISH,
Stone Webster Engineering Corp., Boston, MA.
Y. G. Mussalli, E. P. Taft, J. Larsen, and J. M. Toennies.
Journal of the Energy Division, Proceedings of the American Society of Civil Engineers, Vol 107, No EY1, p 79-94, May, 1981. 12 Fig, 1 Tab, 4 Ref.

Descriptors: *Intakes, *Entrainment, *Hydraulic models, *Fish guiding, Intake gates, Nuclear powerplants, Environmental effects, Cooling water, Water resources development, Ecological effects, Water management, Model studies, Lake Ontario.

A wide-spaced louver offshore intake structure designed to prevent the impingement of fish is described. The louvers are designed to divert fish to a bypass which leads to a submerged jet pump for discharge at a remote location. The system was tested in laboratory, scale hydraulic model, and prototype studies for use in the proposed Nine Mile Point Nuclear Station to be constructed on Lake Ontario. Fish diversion efficiencies of the structure ranged from 23 to 91%. Louver orientation and shape affected the velocity and flow distribution along the louvers, which in turn affected the fish diversion efficiencies. Better fish guidance was enhanced by a gradually increasing velocity gradient into the bypass. A different, highly effective screenwell fish-diversion system was adopted instead of the present system for use at the Nine Mile Point Station nuclear plant. This new system will feature angled traveling screens which will divert fish to a bypass for return to Lake Ontario via a jet pump and transport pipeline. (Geiger-FRC)
W81-06337

EXPERIMENTAL INSIGHT OF TRACE METAL ENVIRONMENTAL POLLUTION PROBLEMS IN MUSSEL FARMING,
Universiti Sains Malaysia, Penang. School of Biological Sciences.
For primary bibliographic entry see Field 5B.
W81-06353

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10D. Specialized Information Center Services

NAWDEX: FOCAL POINT FOR WATER DATA INFORMATION,
Geological Survey, Reston, VA.
M. D. Edwards.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 107, No WR1, p 77-83, March, 1981. 2 Fig.

Descriptors: *Information systems, *Data collections, *Hydrologic data collections, Information retrieval, Data storage and retrieval.

The National Water Data Exchange (NAWDEX) was established in 1976 by the U.S. Geological Survey to coordinate cataloging and indexing of water data and to improve access to this data. Two computerized data bases are available to all users in the water resources community. The Water Data Sources Directory, a compilation of 700 organizations, provides information on location of organization, geographic area of data, types of data, and media in which the data are available. The Master Water Data Index provides information about 370,000 sites, including geographic location, source organization, types of data, periods included, major water parameters, frequency of measurement, and media in which data are available. Nonpoint data have been collected and are presently being indexed. Information is available at 60 assistance centers in 45 states and Puerto Rico. Users may write, phone, or visit the centers. NAWDEX also coordinates its activities with other information systems, including the Department of Interior's Water Resources Scientific Information Center (WRSIC). Through these connections, over 100 bibliographic systems and an index of over 10,000 environmental data files are available. (Cassar-FRC)
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